SCIENCE

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FRIDAY, MARCH 27, 1896.

CONTENTS:

PROPOSED LEGISLATION IN REGARD TO THE METRIC SYSTEM.

WE have received from Professor J. K. Rees, Secretary of the American Metrological Society: (1) The Report submitted to the House of Representatives on March 16th, by Mr. Chas W. Stone, from the Committee on Coinage, Weights and Measures. (2) A copy of the bill reported unanimously by the Committee on Coinage, Weights and Measures of the House. (3) A letter addressed by the American Metrological Society to persons interested in the Metric System. (4) A petition form to be signed by any and all persons favoring the bill. The Secretary will be glad to supply copies of the petition to those who will obtain signatures. In order to keep a record of all signers, the Society requests that a duplicate list be sent to the office of the Society at Columbia University, New York.

INTRODUCTION AND CONCLUSION OF THE REPORT SUBMITTED BY MR. STONE.

Almost the only power clearly and expressly vested in Congress by the Constitution which has remained practically unexercised to the present day is that of fixing the standard of weights and measures. This power is conferred in the fifth clause of Section VIII. of Article 1, which enumerates among the powers of Congress "to coin money, regulate the value thereof and of foreign coins, and fix the standard of

weights and measures." The same power had also been expressly vested in Congress by the earlier Articles of Confederation, and that part relating to the coinage of money was one of the first exercised, and one in relation to which the power of Congress continues to be most fiercely and passionately invoked to the present day.

In the passage of years the power, carrying with it inferentially the duty, to fix the standard of weights and measures seems to have been largely lost sight of. For more than a generation we lived with no legal standard by which could be determined even the amount of metal which went into the coin that came from our mints. Gallatin procured from France a platinum kilogram and meter in 1821 and from England a troy pound in 1827, and in 1828 the latter was recognized as the standard for mint purposes by the following act:

> For the purpose of securing due conformity in weight of the coins of the United States to the provisions of this title, the brass troy pound weight procured by the Minister of the United States at London in the year eighteen hundred and twenty-seven for the use of the mint and now in custody of the mint at Philadelphia, shall be the standard troy pound of the mint of the United States, conformably to which the coinage thereof shall be regulated.

Meantime both the people and the Government were using such weights and measures as were nearest at hand, derived in the main from the English ancestry, but made by themselves without any authoritative standard for comparison, and as a consequence differing materially from each other. In 1830 the Senate directed the Secretary of the Treasury to have a comparison made of the standards of weight and measure used at the principal custom houses of the United States and report the same to the Senate. This was done, and large discrepancies and errors were found to exist. These discrepancies were nullifying and violating the provision of the Constitution which prescribes that "all duties, imposts and excises shall be uniform throughout the United States." Varying scales and varying measures inevitably produced varying rates of duty. The Treasury Department, therefore, in the exercise of its executive power and as a necessary incident and means to the execution of the law and the observance of the Constitution, adopted for the use of that Department the Troughton scale, then in the possession and use of the Coast Survey, as the unit of length, and the troy pound of the mint as the unit of weight. From the latter the avoirdupois pound was to be derived, assuming that there were 7,000 grains in the pound avoirdupois to 5,760 in the pound troy. For measures of capacity the wine gallon of 231 cubic inches and the Winchester bushel of 2,150.42 cubic inches were adopted. This gave to the Treasury Department the basis of a system of weights and measures to be used in its operations, and in order to promote the general adoption and use of the same throughout the country, Congress, in in June, 1836, adopted the following joint resolution:

> That the Secretary of the Treasury be, and he hereby is, directed to cause a complete set of all the weights and measures adopted as standards, and now either made or in the progress of manufacture for the use of the several custom houses, and for other purposes, to be delivered to the Governor of each State in the Union, or such persons as he may appoint, for the use of the States, respectively, to the end that a uniform standard of weights and measures may be established throughout the Union.

In accordance with this resolution sets of the weights and measures adopted for use in the custom houses were sent to the several States, and only in this indirect and inferential way have the customary weights and measures of the United States been legally recognized. By the Act of March 3, 1881, similar sets of standards were directed to be supplied to the various agricultural colleges which had received land grants from the United States at a cost not exceeding

$200 for each set. This law was complied with as best it could be under the limitation of cost prescribed.

Meantime the metric system had come into extensive use among other nations, and into almost universal use in the realm of exact science the world over. We touched it at every turn in our commercial relations and scientific investigations. Uniformity in weights and measures throughout the the world was urged not only by scientists, but by sagacious business men, seeking to keep pace with the rapidly-growing tendencies to closer commercial and business relations among the nations resulting from the improved facilities of communication and transportation which had largely removed the barriers of space and distance. Hence in 1866 Congress, with the approval of the President, placed on the statute books the following law:

AN ACT to authorize the use of the metric system of weights and measures.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after the passage of this Act it shall be lawful throughout the United States of America to employ the weights and measures of the metric system, and no contract or dealing, or pleading in any court, shall be deemed invalid or liable to objection because the weights or measures expressed or referred to therein are weights or measures of the metric system.

SEC. 2. *And be it further enacted*, That the tables in the schedule hereto annexed shall be recognized in the construction of contracts, and in all leading proceedings, as establishing, in terms of the weights and measures now in use in the United States, the equivalents of the weights and measures expressed therein in terms of the metric system; and said tables may be lawfully used for computing, determining and expressing, in customary weights and measures, the weights and measures of the metric system.

To make this law of practical use the following joint resolution was adopted:

JOINT RESOLUTION to enable the Secretary of the Treasury to furnish each State with one set of the standard weights and measures of the metric system.

Be it resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Treasury be, and he is hereby authorized and directed to furnish to each State, to be delivered to the Governor thereof, one set of standard weights and measures of the metric system for the use of the States respectively.

By inadvertence and without important legal significance the resolutions providing for furnishing the standards became a law before the act authorizing the use of the system. In the same year Congress put it in the power of the Post-Office Department to make extensive use of metric weights in its operations. The law of that year was restated and reënacted in 1872 and now stands in the Revised Statutes in the following terms:

The Postmaster-General shall furnish to the post-offices exchanging mails with foreign countries, and to such other offices as he may deem expedient, postal balances denominated in grams of the metric system, fifteen grams of which shall be the equivalent for postal purposes, of one-half ounce avoirdupois, and so on in progression.

The International Postal Convention of two years later, and which by subsequent renewals is now in force between the United States and fifty other nations, uses only metric weights and terms, and to-day the mail matter transported between this country and other nations, even between the United States and England, is weighed and paid for entirely in terms of metric weights.

Here legislation on the subject of weights and measures rests till 1893. In the meantime important action was taken by the Executive Department of the Government. The progress of science, carrying with it the capability of more accurate observation and measurement, had disclosed the fact that the metric standards in use in different countries differed among themselves, and indicated that even the standards in the archives of France could be constructed with greater precision and accuracy and

preserved with greater safeguards against possible variation from influence of the elements or other forces. Hence France invited the other nations to join in an international commission for the purpose of constructing a new meter as an international standard of length. This country accepted the invitation and was represented in the commission, which met in 1870 and continued its labors from time to time till they were finally consummated in the conclusion of a metric convention signed on May 20, 1875, by the representatives of the following nations, viz.: The United States, Germany, Austria-Hungary, Belgium, Brazil, Argentine Confederation, Denmark, Spain, France, Italy, Peru, Portugal, Russia, Sweden and Norway, Switzerland, Turkey, and Venezuela.

The first name signed to this convention is that of E. B. Washburn, the United States Minister and Representative. The treaty provided for the establishment and maintenance, at the common expense of the contracting nations, of "a scientific and permanent international bureau of weights and measures, the location of which shall be Paris," to be conducted by "a general conference for weights and measures, to be composed of the delegates of all the contracting governments." Beyond the construction and custody of the international standards and the distribution to the several countries of copies thereof, it was expressly provided as to this conference by the terms of the treaty or convention that "it shall be its duty to discuss and initiate measures necessary for the dissemination and improvement of the metrical system." This convention was duly ratified by the Senate, and since that time the United States has been regularly represented in the International Conference and has paid its proper proportion of the cost of maintaining the International Bureau of Weights and Measures. By the terms of the convention the privilege of acceding thereto and thus becoming a party to it was reserved to any nations desiring to avail themselves thereof, and accordingly the following nations have since become parties to the convention, viz., Servia in 1879, Roumania in 1882, Great Britain in 1884, Japan in 1885 and Mexico in 1891.

New standards were prepared with extreme care and accuracy, and duplicate copies thereof distributed to the several nations. Those for the United States were received with much ceremony at the White House, January 2, 1890, by the President in the presence of members of his Cabinet and other distinguished gentlemen, and are now carefully guarded in a fire-proof room set apart for the safe-keeping of the standards of weights and measures in the Coast Survey building.

By formal order of the Secretary of the Treasury of April 5, 1893, the meter and kilogram thus received and kept were recognized as 'fundamental standards' from which the customary units of the yard and pound should be thereafter derived in accordance with the law of July 28, 1866.

Meantime Congress by act of March 3, 1893, established a standard scale for measurement of sheet and plate iron and steel, expressed in terms of both the customary and metric measures. 'An act to define and establish the units of electrical measure' was passed by the Fifty-third Congress and approved July 12, 1894. It is based on the metrical system exclusively.

From this résumé of our legislation on the subject of weights and measures it appears that a legal standard of weight has been established for use in the mint, but that beyond that our weights and measures in ordinary use rest on custom only with indirect legislative recognition; that the metric weights and measures are made legal by direct legislative permission, and that standards of both systems have

been equally furnished by the Government to the several States; that the customary system has been adopted by the Treasury Department for use in the custom houses, but that the same Departmnet by formal order has adopted the metric standards as the 'fundamental standards' from which the measures of the customary system shall be derived. This presents a condition of legal complication and practical confusion that ought not to continue. The constitutional power vested in Congress should be exercised. Before considering how this should be done, it may be instructive to consider the attempts that have heretofore been unsuccessfully made in that direction.

* * * *

Your committee are not blind to the fact that considerable temporary inconvenience will accompany the change, but they believe that this is greatly overestimated and that it will be of short duration. This belief is founded on the experience of other nations less agile and versatile of intellect than we are, but whether the inconvenience be little or great it must some time be encountered, and it will not be decreased by the increase of our population. It will be no easier for a hundred millions of people ten years hence to make the change than for seventy millions to-day. It is simply a question whether this generation shall accept the annoyance and inconvenience of the change largely for the benefit of the next, or shall we selfishly consult only our own ease and impose on our children the double burden of learning and then discarding the present 'brain-wasting system.' The present generation must meet this test of selfishness or unselfishness, and answer to posterity for duty performed or neglected. The neglect of our fathers cannot justify us. They delayed for a greater light and clearer way. Passing years have brought the light, and the action of other nations has cleared the way.

A nation ordinarily progressive can not longer afford to linger in the rear of this great movement. A position of isolation is not consistent with American capacity or American destiny. Her sister American republics have appealed to this country to unite with them in this great reform. Her great Secretary of State joined in this appeal. Successive Secretaries of the Treasury, including the present head of that Department, have formally recommended it. Other eminent citizens, many representatives of a great commercial interest, the prevailing sentiment among her educators, the practically unanimous voice of her scientific men, ask for this legislation. By formal memorial the Governor and Legislature of a sovereign State join in this appeal. The experience of other nations confirms the belief in its wisdom. The commercial interests of our people, the economy of time, the saving of effort, even national honor, demand action on this subject.

The signature of our duly accredited representative leads the signatures to the compact of 1875, creating an agency "to discuss and initiate measures necessary for the dissemination and improvement of the metrical system," and since then she has been one of the largest contributors and most prominent actors in the work of guarding and testing the international metric standards and of constructing and distributing prototype copies of the same to other nations. On what theory are we thus zealously engaged in the 'dissemination' of the metric system except that its universal use is desirable; and if desirable for the other nations, why not for the United States? "With what measure ye mete, it shall be measured to you again."

In 1888 (by resolution of May 24) this country invited the republics of Central and South America, Mexico, Haiti and San Domingo, to a conference to be held in the city of Washington to consider among other things 'the adoption of a uniform system

of weights and measures.' The invitation was accepted; the conference was held. To the extent of its power it adopted a uniform system of weights and measures. The other nations, parties to the conference, with scarcely an exception have honorably proceeded to put in force in their respective limits the metric system thus adopted. On what principle of international honor can the United States, the originator of the conference, stand alone in refusing or delaying to abide by its action? What possible motive can this country have in thus coquetting longer on this subject with the nations of Europe and her sister republics? Having sought the verdict of a tribinal of our own choosing shall we fail to stand by its decision? A nice sense of honor, no less than her own interests, would seem to demand from the United States definite and complete action which should put her in full accord on this subject with the nations with which she has so long ostensibly been coöperating.

Your committee in the investigation of this subject have not only heard such gentlemen as saw fit to come before them, but they sought the views of officers of the Government whose work would be most directly affected by the proposed change. They have examined the facts submitted to former committees of this House, and have availed themselves of the testimony lately taken before the committee of the House of Commons of England in their investigation of this subject extending over several months. They have sought to learn by letters of inquiry to the Superintendent of Public Instruction of each of the States, as well as the Commissioner of Education of the United States, the extent to which instruction is now afforded in the metric system in the various States. The replies indicate that this instruction varies much as the educational progress of the States varies. Utah has placed in her constitution a provision requiring such instruction in all the public schools. In all the States the instruction is largely abstract and theoretical, and necessarily so, but the moment the system goes into practical operation, or it becomes certain that it is to go into operation at no very distant date, the character of the instruction will at once change and become practical. The English school authorities are already furnishing to schools asking for them actual specimens of the liter, meter, etc., and a similar course by the school authorities of this country would be wise.

Your committee, after a careful consideration of this subject, have unanimously reached the conclusion that the metric system of weights and measures should be put into exclusive use in the various Departments of the Government at such future date as shall allow adequate preparation for the change, and at the end of a fixed time thereafter that said system shall be recognized as the only legal system for general use. They, however, do not deem it wise at present to require a change in the methods of surveying the public lands, as this would in that respect destroy rather than promote uniformity.

Your committee also deem it prudent to enlarge the time for the proposed system to take effect to a date somewhat later than the date proposed in the bill submitted, adopting for this country about the average time deemed necessary by other nations. Your committee, therefore, recommend that the time for adoption in the Departments and operations of the Government, except in the completion of the survey of the public lands, be fixed for July 1, 1898, and that the adoption of the metric system for use in the Nation at large be fixed as coincident with the dawn of the twentieth century, and that date be accordingly changed to January 1, 1901, the first day of the new century.

Your committee also deem some changes

in phraseology desirable in the proposed law to avoid ambiguity and uncertainty. To most clearly and intelligently express those proposed changes and the scope of the bill after they are made, your committee have embodied them in a substitute bill which they report herewith and respectfully recommend that it do pass.

A BILL to fix the standard of weights and measures by the adoption of the metric system of weights and measures.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after the first day of July, eighteen hundred and ninety-eight, all the Departments of the Government of the United States, in transaction of all business requiring the use of weight and measurement, except in completing the survey of the public lands, shall employ and use only the weights and measures of the metric system.

SEC. 2. That from and after the first day of January, nineteen hundred and one, the metric system of weights and measures shall be the only legal system of weights and measures recognized in the United States.

SEC. 3. That the metric system of weights and measures herein referred to is that in which the ultimate standard of mass or weight is the international kilogram of the International Bureau of Weights and Measures, established in accordance with the convention of May twentieth, eighteen hundred and seventy-five, and the ultimate standard of length is the international meter of the same bureau, the national prototypes of which are kilogram numbered twenty and meter numbered twenty-seven, preserved in the archives of the office of standard weights and measures.

SEC. 4. That the tables in the schedules annexed to the bill authorizing the use of the metric system of weights and measures passed July twenty-eighth, eighteen hundred and sixty-six, shall be the tables of equivalents which may be lawfully used for computing, determining and expressing the customary weights and measures in the weights and measures of the metric system.

LETTER SENT ON MARCH 15, 1896, FROM THE OFFICE OF SECRETARY, AMERICAN METROLOGICAL SOCIETY, COLUMBIA UNIVERSITY, NEW YORK.

DEAR SIR: You are aware, no doubt, that the Committee on Coinage, Weights and Measures, of the House of Representatives, Hon. C. W. Stone, Chairman, has directed that a favorable report be made, to the House, of a bill making the use of the metric system obligatory in the United States after certain dates named in the bill. The bill reported is a substitute for the Hon. D. M. Hurley's bill. A copy of the substitute bill is enclosed.

It is very important that all interested in this bill should act promptly and vigorously.

If you are in favor of the bill sign the enclosed petition and obtain on it the signatures of friends in your neighborhood. Mail the signed petition, with a personal letter, as soon as practicable, to your Representatives in Washington, D. C. Kindly send the Society a postal card stating when you sent the petition and the number of names signed.

The Society would be glad to know the condition of feeling toward the metric system in your vicinity.

Yours respectfully,

B. A. GOULD,
President.
J. K. REES,
Secretary.

FORM OF PETITION.

The undersigned citizens residing in his Congressional District respectfully urge the Honorable Mr. ———— to consider favorably and vote for the bill reported to the House of Representatives by the Committee on Coinage, Weights and Measures, to fix the standard of weight and measures by the adoption of the metric system of weights and measures.

ON THE REFLECTION OF THE RÖNTGEN RAYS FROM PLATINUM.

THE interest connected with this subject led me on March the 9th to undertake a

set of experiments, and indications were almost immediately obtained that a small percentage of the so-called X-rays were reflected by a platinum surface placed at an angle of forty-five degrees. The exposure of the sensitive plate, however, was not sufficiently prolonged; neither was it properly shielded from the anode end of the discharge tube. Matters were finally arranged so that the plate-holder was completely shielded from all parts the discharge tube by screens of heavy sheet lead, and on March 13th, after an exposure of ten hours, a satisfactory negative was obtained, capable of furnishing prints.

The apparatus employed was of the simplest character; a coil of moderate size, made by Ruhmkorff more than thirty years ago, was excited by a current suitable for class-room experiments, no condenser whatever being employed. The Crookes' tube was of German make, and had originally been intended only for class demonstrations. With aid of a fluorescent screen it had been carefully studied, and the best portion of it was employed. The reflecting surface consisted of a new sheet of ordinary platinum foil, which was held rather loosely against a plate of glass, no attempt being made to remove its accidental deformations, which were mainly paralleled to the axis of the cylinder, which it had formed when rolled on its stick. These elongated deformations, convex and concave, were placed vertically.

The plate holder, in addition to its draw slide, was completely covered by a plate of aluminium with a thickness of 0.17 mm.; the central horizontal portion of this was again covered by a broad strip of the same aluminium plate, and over the whole was fastened a netting of iron wire, destined to furnish the image. I may remark in passing that I have found wire netting very useful in other experiments with the X-rays, as it gives instant information as to the condition of the field with regard to uniformity of illumination, single or double sources of the rays, and also with regard to the relative transparency of objects placed on the plate holder.

The plate holder being arranged as indicated, care was taken that rectilinear emanations from the discharge tube should not even reach the external wooden portions of its frame.

After an exposure of ten hours it was found that a good image of the netting had been produced on the vertical strip of the plate exposed to the reflected rays. This image had various deformations, the vertical lines representing the netting being as a general thing most distinct; in some places, however, the horizontal lines had the upper hand, and there were a few spots where both were equally distinct. The image under those portions protected by two thicknesses of aluminium plate was perhaps a trifle fainter than that on the rest of the plate. These facts and the character of the deformations point very strongly to the conclusion that in the act of reflection from a metallic surface the Röntgen rays behave like ordinary light.

Photographic experiments were then made to ascertain the percentage of the rays reflected. A plate from the same box was placed at a corresponding distance (6.5 inches) from the discharge tube, and the exposure diminished, till a similar image was obtained. It was, of course, protected in the same way as in the experiment on reflection, and developed for the same length of time. This image was not in any way deformed. After an examination of it by Mr. F. J. Harrison, Professor Hallock and myself, the conclusion was reached that the reflected image had the same intensity. This would indicate that platinum foil reflects the $\frac{1}{260}$ part of the X-rays incident on it at an angle of 45°. Of course this figure is to be regarded as a first approximation.

In conclusion, I may add that the great-

est care was taken to obtain the most sensitive plates and the most powerful developer known, and that this matter gave much more trouble than the experiment just described. OGDEN N. ROOD.

COLUMBIA UNIVERSITY, NEW YORK.

FURTHER EXPERIMENTS WITH X-RAYS.

PHOTOGRAPHS have now been obtained with several of the Crookes tubes in the cabinet of the Dartmouth Laboratory, but the one referred to in a previous communication is by far the most efficient, and it has been used in nearly all the experiments now to be described. This tube was made by Stoehrer, of Leipzig, being No. 1147 of his catalogue, where it is designated as Puluj's neue Phosphorescenz-Lampe. It contains a mica diaphragm coated with some phosphorescent substance, and gives quite a brilliant green light when in action (although this brilliancy is doubtless immaterial to the production of the X-rays).

As to the source of the X-rays developed by this tube it may be stated that a variety of experiments have shown that they originate in the diaphragm itself where exposed to the cathode rays, and not to any appreciable degree in the glass around the diaphragm. Cathode rays which pass through the diaphragm appear, however, to develop X-rays at the surface of the glass where they impinge.

The method first adopted for determining the position of the source was that of calculating its distance from the plate from the magnification of the shadows of intervening opaque objects, but this procedure brought out anomalies, as will presently be mentioned. By bringing the plate near the tube, the diaphragm could be made to cast its own shadow, and the resulting appearance leaves no doubt that the X-rays chiefly originate in a limited portion of the diaphragm. The method of using a series of parallel films leads to the same conclusion, and indicates that in this tube the rays do not proceed directly from the cathode itself.

Lenard has observed that the cathode rays are diffracted around the edges of obstacles. In case of the X-rays our experiments indicate an effect apparently somewhat the reverse of this. While the shadow of an obstacle is always magnified, and often to a degree disproportionate to the distances involved, we have obtained several plates showing the impression from an aperture in an opaque object to be slightly minified, when the plate is sufficiently near the object. This would point to an outward rather than an inward bending of the rays. In this connection attention is called to a curious phenomenon presenting to the eye the appearance of irradiation, although it is difficult to believe that any real analogy to irradiation is offered.

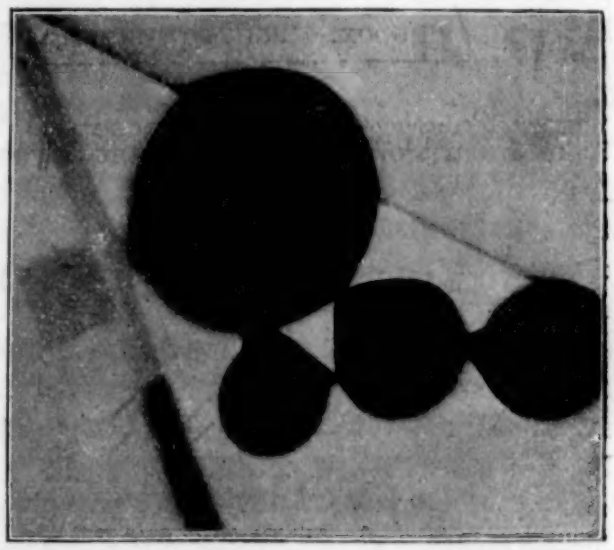

FIG. 1. DISTORTION OF COINS PHOTOGRAPHED WITH X-RAYS.

The coins shown in Fig. 1, are a silver dollar, a dime, and two nickels, in contact, all perfectly round; a glass rod (ending in a brass cap) touches the dollar, and a small piece of hard rubber prevents it from rolling. The line across the plate, through the shadow of the dollar, is the image of the mica diaphragm, the plane of which was nearly perpendicular to the

plate. The tube was but 14 mm. above the coins and 17 mm. above the film. The magnification of the shadows is slight, but the distortion is almost grotesque. Plates showing this effect can be easily obtained.

It should be stated that the nearness of any conductors, as these coins, to the tube in action will produce in them a considerable static charge, as may be readily tested by a proofplane and electroscope. This may possibly have a bearing upon the cause of the distortion.

The rectilinear path of the X-rays after they have passed by an obstacle has been proved by the use of a long strip of celluloid film, as used in Kodak cameras. A framework like two parallel ladders was so made that the film could be tightly drawn across the rounds with successive portions parallel and at a distance of 10 mm. from each other, the whole being enclosed in a light-tight box. The X-rays so readily penetrated the gelatine and celluloid that their effect could be seen through more than twenty of these equidistant layers. A circular piece of silver was attached to the celluloid side of the front film, and the diameter of its shadow could after development be quite accurately measured on eight successive layers, although growing diffuse as the distance increased. The ratio of the successive diameters was constant, as would be the case with a rectilinear path. Of course the axis of the 'shadow cone,' given by the position of the circles of the shadow, passes through the source of the rays. On some of the films exposed in this way very curious markings are seen which we are as yet unable to explain.

This use of films at once suggests the need of a new kind of sensitive plate for photographing with X-rays which shall absorb them far better than does the ordinary dry plate. When a strip of film was folded up on itself, so that there was no loss of intensity by increase of distance from source, the impression was hardly less strong on the twelfth than on the first layer; and an impression could doubtless be transmitted through a hundred layers. It follows that the time of exposure necessary for X-ray photographs could be diminished in proportion as the plates are made to absorb the energy falling upon them. On account of the opacity of platinum, it occurred to me to try platinum photographic paper of the kind used for portraits, but such paper (intended for long exposures in printing in sunlight) was far too lacking in sensitiveness to produce any effect. It ought to be easily possible for our photographic chemists to produce plates which should require but one-twentieth or less of the exposure now required for X-rays with ordinary plates.

The writer has succeeded in repeating Röntgen's reflection experiment, except that a celluloid film was used instead of the less permeable glass plate. Nickel and copper disks were attached to the under side of the film, and after exposure (70 minutes) their effect in reflection was shown by the greater intensity of the dark (or negative) circles above them.

Certain plates gave anomalous results of reflection, the portion of film above the reflecting object being affected less intensely than the rest of the film; that is, the outline of the object *beneath* the film is shown, but is lighter on the negative than the surrounding area, instead of darker, as would be expected.

On four of our plates an appearance strikingly like interference fringes can be observed, and thus far we can only account for it on the supposition of reflection from the brass spring which presses against the glass side of the plate in the holder, thus keeping the plate in place. Numerous attempts have been made to obtain interference fringes after the analogy of Newton's rings, but thus far unsuccessfully.

The difficulty found by Professor Emerson and myself in *precisely repeating* most of these experiments has doubtless been experienced by others working with the X-rays. When the conditions of an exposure seem identical with those of a previous one, the results often differ, from varying excitation of the tube, or possibly slight shifting of the source of the rays, or from numerous other causes difficult to control. A confirmation of results by other observers is therefore valuable.*

Since the last paragraph was in type I have succeeded in proving that the 'fringe' is due to the spring by the somewhat surreptitious method of placing a second Crookes tube behind the plate, and thus projecting a shadow of the spring itself upon the plate on which at the same time the spring was reflecting the fringe. Fig. 2, is from a plate obtained a fortnight ago. A silver dollar lay on the slide above the plate, directly over the spring which was behind the plate; the tube was 14 mm. above the plate and the exposure was one hour. The X-rays must have passed through the silver dollar and then have been reflected by the spring, giving the 'fringe.' Since the central bright line is much brighter than the other portions of the plate partially screened by the dollar, it would seem that this additional brightness can only result from the superposition of waves in the same phase, or, in other words, from something closely akin to interference. Similar fringes have been obtained through tinfoil instead of silver, and also where no obstacle intervened between tube and film. We hope by this method to obtian the wave-length of the X-rays.

EDWIN B. FROST.

HANOVER, N. H., March 10, 1896.

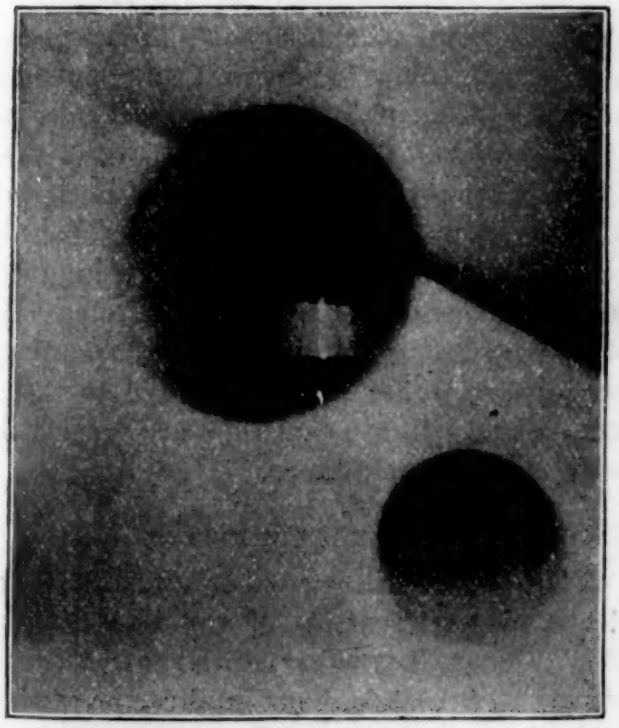

FIG. 2. SHOWING REFLECTION AND INTERFERENCE OF X-RAYS.

*In a previous communication (p. 235), a slip of the pen made me invert the order of permeability of hard rubber, glass and brass; the rubber is of course the most permeable.

THE RECEPTION OF FOREIGN STUDENTS IN FRENCH UNIVERSITIES AND SCHOOLS.

IN order to carry out effectively the plan for the reception of foreign students in the schools of France, in which there is now so much interest, the French government has formed a Committee of Patronage for the purpose of receiving new comers, giving them encouragement, and furnishing them with all necessary information in regards to their studies and facilities for life in the university towns. The object of these Committees is to make the student's stay in France agreeable as well as profitable. They also offer their friendly offices to the families of students.

THE PARIS COMMITTEE.

The Paris Committee has its headquarters at the Sorbonne, and is composed of the following members:

MM. Emile Boutmy, Member of the Institute; Director of the *École libre des sciences politiques* Michel Bréal, Member of the Institute. Xavier

Charmes, Member of the Institute. Darboux, Dean of the Faculty of Science. Gréard, Member of the French Academy; Rector of the *Academie de Paris*. Himly, Dean of the Faculty of Letters. Lamy, formerly Deputy. Lavisse, Member of the French Academy. Liard, Director of Higher Education. Paul Melon, General Secretary. Georges Picot, Member of the Institute. Albert Sorel, Member of the Institute. Vicomte Melchior de Vôgue, Member of the French Academy.

A secretary is stationed in the office of the Committee, who will be for two hours each day at the service of persons desiring to obtain detailed information concerning life in Paris or the character of the instruction given in the different educational establishments.

There is an executive committee charged with the duty of maintaining regular connections with the different groups of foreign students in Paris.

The Paris Committee expects to be able to give scholarships of 200 to 350 francs to students especially recommended; these scholarships to be exclusively employed in payment of University fees.

THE COMMITTEE OF AIX.

This Committee, under the patronage of the Rector of the *Académie*, the Mayor of Aix, the Dean of the Faculty of Law and the Dean of the Faculty of Letters, is composed of Prof. Bouvier-Bangillon, of the Faculty of Law; M. Moreau, Adjunct Professor in the same Faculty; Prof. Ducros, of the Faculty of Letters, and M. Carbonel, Secretary of the Faculty of Law.

The Committee has arranged with transportation companies for reduction of fares for the benefit of students, and will neglect nothing which has to do with their moral and material interests.

Special courses of instruction in the French language, for the benefit of foreigners, have for many years been organized in connection with the Faculties of Aix.

THE BORDEAUX COMMITTEE.

This Committee is composed of Prof. Bouchard, of the Faculty of Medicine; Prof. Gayen, of the Faculty of Sciences; Prof. Denis, of the Faculty of Letters, and Prof. Duguit, of the Faculty of Law, acting as Secretary.

THE LYONS COMMITTEE.

This Committee is composed of professors from the four Faculties: Prof. Lepine, of the Faculty of Medicine; Prof. Offret, of the Faculty of Sciences; Prof. Bourgeois, of the Faculty of Letters, and Prof. Berthelemy, of the Faculty of Law. There is, besides, a special committee composed of friends of the University, presided over by M. Cambfort, which will give special attention to questions connected with the interests of foreign students. The Secretary of this Committee is M. Thallers, of the Faculty of Law.

THE MONTPELLIER COMMITTEE.

This Committee has as its Secretary Prof. Flahaut, of the Faculty of Sciences, and, among other members, Prof. Bonnett, of the Faculty of Letters; Prof. Gidde, of the Faculty of Law; Prof. Gachon, of the Chair of History in the Faculty of Letters; M. Tempie and others. It has established certain courses free to foreigners, an elementary course and an advanced one. It will provide students with information concerning living facilities suited to their means, and will see that they are furnished with medical attendance.

THE NANCY COMMITTEE.

This Committee is composed of the four deans of the faculties of the University: MM. Bichat, Heydedireigh, Krantz, Lederlenen, M. Schlagdenhauffen, director of the School of Pharmacy; M. Gavet, associate professor of the Faculty of Law; Prof. Molk, of the Faculty of Sciences; Prof. Bernheim, of the Faculty of Medicine; Prof. Grucker, of the Faculty of Letters, and Prof. Bleicher, of the *École supérieure de pharmacie*.

M. Bichat, Dean of the Faculty of Sciences, and M. Gavet, will devote themselves especially to the interests of foreign students at Nancy.

The Committee has formed in connection with the Students' Association, a special section for colonial and foreign students, the Vice-Presidents of which will be elected by the foreign students.

THE TOULOUSE COMMITTEE.

The President of this Committee is Dr. Maurel, and among its members are public officials of Toulouse, the deans of faculties, the directors of the schools of veterinary science, fine arts and music, and a certain number of persons who are considered by the consular officers resident at Toulouse especially likely to command the confidence of the families of foreign students.

The Committee will correspond with organization abroad or with families who contemplate sending to Toulouse students for a sojourn of some length. It will do all in its power to secure for foreign students engaged in regular courses of study the pecuniary opportunities which are enjoyed by French students. It has arranged with the Students' Association to extend to foreigners all the advantages which belong to its own members, and their admission to such official or private receptions as may occur.

The Committee offers to foreign students the following advantages: The opportunity to draw money in Toulouse without commission or discount; gratuitous medical service; hospital accommodations at half price; free admission to the meetings of the Geographical Society; free admission to the reading room; reduction of rates at hotels selected during the first eight days after arrival, and reception at the railway station, if desired.

THE FRANCO-AMERICAN SYNDICATE.

In connection with this movement there has also been organized by a number of learned and representative men of France, a body called the 'Franco-American Syndicate,' the object of which is 'to promote and develop intellectual, social and moral relations between France and the United States.'

The intention of this Syndicate is to bring American students into direct relations with representative men of France, especially those who are representatives in their several professions.

The gentlemen who have volunteered to assist, not being directly engaged in official duties, have time at their disposal to devote to this work. The Honorary Chairman of the Syndicate is the Comte Carré de Busserolles, Brigadier General, retired, and Commander of the Legion of Honor; its President is Comte Henri du Bourg, and its Vice-President, Mons. P. de Rousiers, the author of a well-known work upon American life; and among its members are the Comte Perouse de Monclos and Mons. G. Balleyguier, architects; Mons. S. Thore, engineer; Mons. O. Coignard, Forestry Inspector; Dr. Chaillou, of the Pasteur Institute, and Mr. J. C. Van Eyck, of New York city, Member of the Royal Institute of the Netherlands. A number of eminent men, several of them members of the Institute of France, who on account of their official positions are unable to take active part in the work of the Syndicate, have promised their support and coöperation, as have also several army and navy officers of high rank.

It is the hope of this organization to have a house in Paris where there may be frequent gatherings of American students for social intercourse with these gentlemen and to listen to lectures, and that here also may be arranged plans for the advantageous utilization of the university holidays for purposes of professional study under the direction of competent Frenchmen.

The representative of the Syndicate in

Paris is Mons. G. Balleyguier, architect, 238, Boulevard St. Germain; and the representative of the organization in the United States is Dr. J. C. Van Eyck, Century Club, New York.

GENERAL INFORMATION FOR STUDENTS.

The following information is given concerning the admission of foreign students into the faculties and schools of France:

Instruction is absolutely gratuitous in the universities and faculties of France. They are open without reserve to strangers as well as to native students, and the grades established are the same for each. It is required, however, that both foreign and native students should give evidence of certain preliminary study. In the case of the French student this consists in the presentation of a bachelor's diploma certifying that courses of secondary instruction of a given nature have been completed. Strangers who have obtained from institutions in their own country certificates of instruction are admitted after a ruling shall have been made by the Minister based upon the advice of the proper section of the Advisory Committee on Public Instruction, whose duty it is to ascertain the actual value of the certificate offered. This is rendered necessary by the fact that the certificates of study in France and in foreign countries are not always equivalent in value.*

The requirements in connection with obtaining degrees in the courses of higher instructions are the following: Matriculation, access to the library, privileges of practical work (only in the faculties of medicine and the schools of pharmacy), examination, certificate of proficiency, and diploma. The fees for matriculation are 30 francs quarterly, or 120 francs per year. Library privileges cost 10 francs per year. The fees for examination and diploma vary from 40 to 100 francs per year, according to the faculties.

These provisions relate only to students who are candidates for degrees. Those who wish simply to receive the instruction given by a faculty, without asking a certificate or diploma, will be permitted the greatest freedom of action.

Foreigners who give evidence of sufficient previous instruction will be admitted into most of the special schools either as pupils or as free auditors.

In a subsequent article, information will be given in regard to the facilities offered by the principal universities and special schools.

G. Brown Goode,

Secretary of the American Branch of the Comité Franco-Americain.

* Graduates of foreign universities who desire to enter the courses of the faculties should address an application to the Minister of Public Instruction, accompanied by (1) the original diplomas, with a request that their equivalence in France be determined, and that they be approved; (2) a certificate of birth (original and translation).

THE ESSENCE OF NUMBER.

Number is primarily a quality of an artificial individual. By artificial is meant 'of human make.' The characteristic of these artificial individuals is that each, though made an individual, is conceived as consisting of other individuals. In language the designations for artificial individuals so characterized usually contain other connotation. Examples are a flock, a herd, a bevy, a covey, a throw, a flight, a swarm, a school, a pack, a bunch, a cluster, a drove, a company, a brood, a group, etc. To any such artificial individual pertains an important quality, its 'Anzahl,' which may agree or differ among such artificial individuals, as may their color. But something like color is made and recognized by insects and animals, so that color is not so highly artificial as number, but will serve for an illustration. Just as the color of a bunch of grapes might be identified by use of a

card of standard colors, and so a particular descriptive color name attached to the bunch, in the same way by a well-known process of identification its 'Anzahl' may be determined and the proper descriptive name attached. This particular process of identification is called counting, and used originally the standard set of artificial individuals makable from the fingers.

The creation of artificial individuals having this numeric quality, 'Anzahl', the creation of number of necessity preceded counting, which is only a subsequent process for identification, for finding the 'Anzahl' where it is already known to be.

Number is so peculiarly human a creation that it might be used as an argument for the unity of mankind. Man has found it advantageous to perceive in nature distinct things, the primitive individuals. Each distinct thing is a whole by itself, a unit. The primitive individual thing is the only whole or distinct object in nature. But the human mind takes primitive individuals together and makes of them a single whole, an artificial individual and names it. These are artificial units, discrete magnitudes. The unity is wholly in the concept, not in nature. It is of human make.

From the contemplation of the primitive individual in relation to the artificial individual spring the related ideas 'one' and 'many.' A unit thought of in contrast to 'many' as not-many gives us the idea *one* or 'a one.' A 'many' composed of 'a one' and another 'one' is characterized as 'two'. A many composed of 'a one' and the special many 'a two' is characterized as 'three.' And so on, at first absolutely without counting, in fact before the invention of that patent process of identification now called counting. The 'Anzahl' of a group is wholly abstract, in that it represents all at once the primitive individuals or elements of the group or artificial individual, and nothing more. There never was and never will be a concrete number or anything concrete about number.

The number in the sense of 'Anzahl' of a group is a selective photograph of the group, a numeric picture which takes or represents only one quality of the group, but takes that all at once. This picture process only applies primarily to those particular artificial wholes which may be called discrete aggregates. But these are of inestimable importance for human life.

This overwhelming importance of the number-picture after centuries led to a human invention as clearly a device of man for himself as is the telephone. This was a device for making a primitive individual thinkable as a recognizable and recoverable artificial individual of the kind having the numeric quality. This is the recondite device called measurement.

Measurement is an artifice for making a primitive individual conceivable as an artificial individual of the group kind, and so having an 'Anzahl,' a number picture.

It may be likened to dyeing cotton with analine dyes. This will give the cotton a color which may then be identified by comparison with the set of standard colors.

The height of a horse, by use of the artificial unit, a 'hand,' is thinkable as a discrete aggregate and so has a number-picture identifiable by comparison with the standard set of pictures, that is by counting, as say 16. But to argue from this the implicit presence of the measurement idea in every number is the analogue of maintaining the implicit presence of the process-of-dyeing idea in every color.

GEORGE BRUCE HALSTED.

AUSTIN, TEXAS.

ROBERT EDWARD EARLL.

MR. ROBERT EDWARD EARLL, who died on March 18th, at 'Chevy Chase,' near Washington, was one of the oldest and most

trusted members of the staff of the Smithsonian Institution, with which he had been connected in various capacities since 1877. He was born at Waukegan, Illinois, August 24, 1853, educated in the Waukegan public schools, the University of Chicago, and at the Northwestern University, where he was graduated in 1877 with the degree of B. S. He entered the service of the Fish Commission, under Prof. Baird, as a fish culturist; in 1878 was transferred to the scientific staff, and from 1879 to 1882 was engaged in the Fisheries Division of the Tenth Census.

From 1885 to 1888 he was Chief of the Division of Statistics in the Fish Commission. He was sent, in 1883, to the International Fisheries Exhibition in London, as a member of the staff of the United States Commissioner, and rendered very efficient service as executive officer and deputy representative. His aptitude for exposition work was so fully demonstrated on this occasion that he has been designated chief executive officer, at all the expositions which have since been held, for the exhibits of the Smithsonian Institution and the National Museum; at Louisville and New Orleans in 1884 and 1895, Cincinnati in 1888, Chicago 1893 and Atlanta in 1895. At the time of his death he had just completed the unpacking of the exhibits returned from the South.

Since 1888 he had been connected with the National Museum, with the grade of Curator, and for three years had been Editor of the Proceedings and Bulletins of the Museum.

He was recognized by his associates as man of fine administrative ability, which, combined with great force of character, had brought him into the position of one of the most efficient exposition experts living. His unselfish devotion to his work, and his absolute trustworthiness were appreciated by all who knew him, and he was exceedingly popular among his associates.

Notwithstanding his constant occupation in executive work, he produced and published a considerable number of important papers in regard to the methods of the Fisheries and the habits of fishes. He was one of the best authorities upon the natural history of the Shad and Herring, and made exhaustive studies of the fishery statistics of the Atlantic and Gulf coasts and of the Great Lakes. Several new fishes were discovered by him, one of which, an important food species of the Southern coast, obtained by him at Charleston in 1881, is called in his honor Earll's Hake, *Phycis Earlii*. He was also a skilful fish culturist and had much experience in the early experimental work in the propagation of the Shad and in the establishment of the Cod-hatching station at Gloucester.

He was a man of the purest personal character. His loss will be deeply felt by many in Washington. By reason of his peculiar abilities and his great experience, his death creates a void which it will be practically impossible to fill.

G. Brown Goode.

CURRENT NOTES ON PHYSIOGRAPHY.

THE STUDY OF HOME GEOGRAPHY IN ITALY.

At the Second Italian Geographical Congress, held in Rome last September, the president, Marquis Doria, included in his opening address an earnest recommendation for the cultivation of home geography. Recognizing the glory of foreign exploration, he nevertheless said that the patient study of the fatherland is a scientific duty, and that the culture of a nation may be measured by its advance. The Congress adopted votes urging the establishment of better courses in geography in various stages of education; and advising the Italian Geographical Society to offer a prize for the best plan of primary instruction in local geography, and afterwards to secure the best geographical writers of Italy to prepare text-

books according to the approved plan for local use. The latter suggestion is one that may be commended to the councils of our American and National Geographical Societies.

THE DANUBE.

A COMPENDIOUS volume on the Danube, by Schweiger-Lerchenfeld (Die Donau als Völkerweg, Schiffahrtstrasse und Reiseroute, Vienna, Hartleben, 1896, 950 p, with many and excellent illustrations and maps) contains much material for the physiographer; truly not the result of original investigation now first published, but well summarized from many sources and acceptable for those who have to study this great international river at a distance. Most serviceable is the description of the various features of the great Hungarian plain, the Alföld, as it is locally called, through which the Danube and its chief tributary, the Theiss, wind their courses. Sand dunes make deserts of large areas; other parts are wet and marshy beyond redemption, and a third division includes the Puszta, or fertile grassy plains. Many districts have been subject to overflow; but these are now reduced by the 'regulation' of the larger rivers, as well as by the construction of dikes. Below the 'Iron gate' in the Carpathians, the course of the Danube has been changed at several points by sand blown into its channel by the southeast storm wind, the 'Koschava,' from an extensive area of ridged dunes. The various narrows of the great river and their improvement for navigation are fully described.

THE LOCATION OF SETTLEMENTS.

DR. A. HETTNER, Privatdocent in geography in the University of Leipzig and editor of a new geographical journal, contributes to it an essay on the geographical controls of human settlements, reviewing the previous literature of the subject and laying down lines along which further research should be conducted (Hettner's Geogr. Zeitschr., i., 1895, 361-375). Somewhat as plants and animals are affected in their distribution by geographical environment, so man himself responds to his surroundings; his personal will having a much less influence than would appear at first sight, although complicating the reaction in a manner not apparent in the case of lower organisms. Just as the features of the land are now best explained by an appropriate historical method of study, based on their geological evolution, so the location of settlements should be studied in relation to their development from their beginnings, and not only in relation to their actual surroundings. The article as a whole is an abstract consideration of the subject, without illustration by specific examples.

MIDDENDORFF'S PERU.

A RESIDENCE of twenty-five years in Peru affords Middendorff an extended experience for record in his work on that country, of which the third volume, Das Hochland von Peru (Berlin, 1895), now follows the second, Das Küstenland (1894). The coastal desert belt, with its irrigable valleys, rises into the highland through dull slopes of rock waste, seldom varied with ledge or cliff, but sometimes trenched by great ravines. Ascending this western slope, the traveler finds himself on lofty barren plateaus, of rather cool climate, holding lakes in their depressions; a special account being given of Titicaca and its surroundings. Very different from the barren ravines of the dry western slope are the deep warm valleys of the rainy and forested eastern slope, in which many streams that head west of the eastern range cut their path on the way to the Amazon.

As in so many books of travel, this one, although the work of an interested observer, loses greatly in geographical value from an insufficient understanding of physi-

ography on the part of the author. The control of topographic form by climate, for example, is sketched rather than described, although the Peruvian Andes exemplify it with an emphasis hardly paralleled elsewhere.

W. M. Da[illegible].
Harvard University.

SCIENTIFIC NOTES AND NEWS.

ZOÖLOGICAL NOMENCLATURE.

The meeting of the Zoölogical Society of London, March 3d, was devoted to a discussion of Zoölogical nomenclature, under the the leadership of the veteran ornithologist, P. L. Sclater, who presented the claims of the Stricklandian code in comparison with that of the German Zoölogical Society. Strickland's code, that formulated for the British Association in 1842, differs from the later one chiefly in the following points:

1. The German rules disclaim any relation to botany, so that, according to them, the same generic names may be used for a plant and for an animal. This is contrary to the Stricklandian code, which, however, is practically a dead letter, in this particular, after fifty-four years of trial.

2. Under the German rules the same term is to be used for the generic and specific name of a species if these names have priority.

This is contrary to the Stricklandian code, and also to the usage of many American zoölogists, though practiced by those who accept fully the rules of the American Ornithologists' Union.

The German rules adopt the 10th edition of Linnæus's Systema Naturæ as the starting point of zoölogical nomenclature, whereas the other adopts the 12th. The 10th is universally accepted on this side of the Atlantic.

These differences are but trifling, and it is probable that they will all be reconciled through the agency of the nomenclature committee appointed at the Leyden meeting of the International Zoölogical Congress.

THE TORONTO MEETING OF THE BRITISH ASSOCIATION.

Nature states that the Toronto Local Committee are assiduously engaged in preliminary work for the meeting of the British Association for the Advancement of Science in 1897. Meetings of the executive committee are held every fortnight. Besides the executive committee, a number of sub-committees are at work, including those on finance, conveyances, publication and printing, rooms for offices, meetings of the association and committees, hotels and lodgings, press, hospitality, reception and for securing coöperation of other institutes, associations and corporations, postal, telegraph and telephone facilities. The attention of the committee on conveyance has already been called to the desirability of securing from the Canadian Pacific Railroad transportation for such members of the Association as may desire to extend their travels to the Pacific coast, with special reference to the suggestion that a meeting of the American Association for the Advancement of Science may follow the Toronto meeting, if adequate facilities for transportation are assured. This suggestion is based upon the fact that the American Association have already once voted in favor of such a meeting if satisfactory rates could be obtained; and the hope is still entertained that delegates from both British and Australasian Associations might find San Francisco a convenient point at which to meet the American Association. Mr. Griffith, the general secretary of the British Association, is exexpected to be in Toronto about May 22d, to make arrangments for the meeting, and set out the proper lines of work. The chairman of the local committee is Dr. A. B. Macallum.

ENTOMOLOGY.

It has always been assumed that flowers attracted insects, in large measure at least, by the splendor of their inflorescence. Some recent experiments by Plateau, recorded in the Bulletin of the Belgian Academy, throw doubt upon this assumption. In a considerable bed of showy dahlias Plateau concealed from sight the highly colored rays of some of the flowers exposing only the disk, and in a second series of experiments the disk also but independently, either by means of colored papers or by green leaves secured in place by pins. Butterfles and bees sought these flowers with the same avidity and apparently the same frequency as the fully ex-

posed flowers in the same patch, the bees particularly pushing their way beneath the obstacles to reach them, though not always with success. Plateau concludes that they are guided far more by their perception of odors than by their vision of bright and contrasted colors.

IN a second communication to the same Academy Plateau gives the details of another set of experiments to determine whether a wide-meshed net presents any obstacle to the passage of a flying insect which, as far as room was concerned, could easily pass in flight through the interstices. He finds that, while such nets do not absolutely prevent passage on the wing, insects almost invariably act before one they wish to pass as if they could not distinguish the aperture, ending by alighting on the mesh and crawling through. He reasons that through the lack of distinct and sharp vision the threads of the net produce the illusion of a continuous surface, as for us the hatchures of an engraving, seen at a distance.

ASTRONOMY.

THE Royal Astronomical Society have introduced an innovation in their method of issuing the 'Monthly Notices.' These are now to appear in parts, whenever it seems desirable that this should be done. Heretofore the Notices have appeared once each month, so that it has not always been possible to avoid delay in the publication of important papers. It is not intended that there shall be more than one number each month in the future, but this number will be divided, and issued in parts, when necessary.

THE *Astronomical Journal* of March 11, contains an article by Dr. G. W. Hill, on the perturbations of the planet Ceres by Jupiter and the derivation of the mean elements of Ceres.

THE last number of the *Astronomische Nachrichten*, dated February 29th, contains the announcement from Dr. Belopolsky of Pulkowa that he has obtained a series of good measures of the motion in the line of sight of the brighter component of 61 Cygni. The observations were made with the 30-inch telescope. The motion relatively to the sun is found to be —7.3 geographical miles. Assuming a parallax of 0″.5 and a proper motion of 5.″2, allowing for that of the sun, Dr. Belopolsky finds that the actual motion of the star is at the rate of 7.6 geographical miles per second. The direction of the motion in space has a position angle of 61° and makes an angle of 140° with the line of sight. H. J.

GENERAL.

WE have received from the Huxley Memorial Committee a second donation list containing further subscriptions amounting to £761. The total amount is now £2,300. A sufficient sum being thus guaranteed for the fulfillment of the two first objects of the Committee, 'Statue' and 'Medal' Sub-Committees have been appointed to carry on the details, and designs are now being prepared. For the third object, the foundation of Exhibitions, Scholarships or Lectureships has been proposed. For this a considerable sum will be required, and the efforts of the Committee to raise it are being promoted by the organization of Local Committees in all parts of the world.

A BRANCH of the International Committee to erect the monument to Pasteur has been formed in Washington, under the presidency of Dr. D. E. Salmon, of the United States Department of Agriculture. Among the members are Secretary Langley, Surgeons-General Tryon, Sternberg and Wyman, Dr. G. Brown Goode and a representative to be appointed by each of the scientific societies.

The series of Saturday lectures, complimentary to the citizens of Washington, will be continued during the season of 1896, under the auspices of the Joint Commission, and under the direction of a committee consisting of W J McGee, G. Brown Goode and J. Stanley Brown. The addresses will be delivered in the lecture hall of the National Museum, 4:20 to 5:30 p. m., on the dates specified. The series of lectures for 1896 has been arranged with the view of illustrating the relations of life to environment, especially on this continent; and two courses have been provided, the first pertaining chiefly to vegetal and animal life, the second chiefly to human life in its relations to lower organisms as well as to the inorganic world. The first course is as follows (the second will be announced later):

March 21, *The Battle of the Forest*, B. E. Fernow; March 28, *The Adaptation of Plants to the Desert*, F. V. Coville; April 4, *The Spread of the Rabbit*, T. S. Palmer; April 11, *Insect Mimicry*, L. O. Howard; April 18, *The Persistence of Functionless Structures*, F. A. Lucas.

DR. G. F. BECKER, of the U. S. Geological Survey, sailed, March 14th, for Capetown, to make an investigation of the South African gold fields.

MR. F. W. TRUE, of the National Museum, is engaged upon a study of the antlers of American deer. His monograph of the family of moles is just going to press.

KICKING BEAR, one of the finest representatives of the Sioux tribe, and one of the few thoroughly typical examples of the uncontaminated Indian, was thoroughly modeled and photographed at the National Museum on March 13th, and a full figure to be clad in the costume which he now wears on ceremonial occasions will be constructed.

DR. JOHN S. BILLINGS and Prof. Simon Newcomb have been designated by the Secretary of State to represent the United States at the Bibliographical Conference to be held in London at the call of the Royal Society.

ADMIRAL MAKAROFF, of the Russian Navy, the author of a very important work upon the currents and specific gravity of the waters of the northwestern Pacific, during a recent visit to Washington, at an informal meeting at the Smithsonian Institution, on March 16th, explained his methods and results to a number of gentlemen interested in hydrography and deep sea explorations.

THE astronomical work of Dr. S. C. Chandler, of Boston, and especially his studies upon the variations of latitude, have been recognized by the Royal Astronomical Society of London, which conferred upon him its gold medal at its meeting on February 14th.

LIEUTENANT COMMANDER J. J. BRICE, U. S. N. (retired), who has been nominated by President Cleveland for the position of U. S. Commissioner of Fisheries, is a citizen of California, and has given much attention to the acclimatization of pheasants. He is interested in angling, and was in 1891 employed under the late Commissioner MacDonald to make a reconnoissance preparatory to the establishment of fish-cultural stations on the military reservations of the Pacific coast and the Rocky Mountains. It is not understood that he makes any claim to be possessed of proved scientific and practical knowledge of the fishes of the coast.

A COMMEMORATIVE tablet has been placed on a school in Passy to record the former residence of Franklin at that place, then a suburb of Paris. Addresses were made by M. M. Faie and Guillois.

PROF. WILLIAM LIBBEY, of the department of physical geography of Princeton University, is organizing a second expedition to the Hawaiian Islands. He will be accompanied by a number of students and will be absent from the close of the college year to the opening in September.

DURING February, 1373 volumes were added to the New York State Library, the total number of volumes in the library, including traveling libraries and duplicates, being now 318,964.

THE officers for the New York Academy of Sciences for the coming year are: President, J. J. Stevenson; First Vice-President, H. F. Osborn; Second Vice-President, R. S. Woodward; Corresponding Secretary, D. S. Martin; Recording Secretary, J. F. Kemp; Treasurer, C. F. Cox; Librarian, Arthur Hollick.

FRENCH is to be recognized as the official language at the twelfth International Medical Congress to be held at Moscow in August, 1897. At the general assemblies speeches may be delivered in other European languages. The sectional papers and discussions must be either in French, German or Russian. The exclusion of English will probably interfere with the attendance of members from Great Britain and America.

A SERIES of lectures has been arranged to increase interest in the Inter-State park at the Dalles of St. Croix, Minnesota and Wisconsin. Among the lecturers are Mr. Warren Upham, Prof. Henry L. Osborn and Prof. Conway MacMillan.

THE New York Board of Fire Underwriters, on the basis of a report prepared by Professor Henry Morton, of the Stevens Institute, has re-

solved not to insure any building in which acetylene gas is regularly used.

A TELEGRAM to the daily papers states that a meteorite, said to be twenty feet in diameter, has fallen on Pine Mountain, which is located on the Kentucky River, about twenty-five miles from Hindman, Ky. A house is said to have been destroyed and the family buried beneath the debris. While no great reliance can be placed on such reports, the one in question perhaps deserves investigation.

WE have received from the publishers J. U. Kern's Verlag, Breslau, and also from the importers, Lemcke and Buechner, New York, the first number of a new quarterly journal, *Centrallblatt für Anthropologie, Ethnologie und Urgeschichte*, edited by Dr. G. Buschan, with the coöperation of the leading students of anthropology, including Dr. D. G. Brinton, Dr. Franz Boas and Dr. W. Hoffman. The present number contains, in additon to a preface by the editor and a short article by Prof. Sergi, reviews of 112 books and articles.

THE Cambridge University Press has in preparation, as the second volume of the Cambridge Geographical Series, 'The Geographical Distribution of Mammals,' by R. Lydekker.

THE Association for Improving the Condition of the Poor has arranged a series of lectures for the promotion of the agricultural, horticultural and dairy interests of Westchester county. At Pleasantville, last week, Mr. George T. Powell spoke on apple culture; Mr. M. V. Slingerland, assistant entomologist at Cornell University, on insects; Prof. J. W. Sanborn, Lower Gilmanton, N. H., on 'Intensive Methods of Eastern Farming,' and Mrs. Ann B. Comstock, of Ithaca, on flowers and their insect friends. In the neighborhood of places such as Ithaca, where agricultural instruction is given, improvement in methods of farming and gardening has taken place, and it is the object of the Association to extend such instruction more widely.

IT is reported that platinum in quantities sufficient to repay mining has been discovered at Swift Water, a small camp at the foot of Buffalo Peek, Colo.

M. PAUL DE HUMY, a French naval officer, has invented a process for solidifying petroleum. It is said that common oil has been converted into a solid block as hard as anthracite coal, and that it will burn slowly, giving off intense heat. A ton of this fuel is said to represent thirty times its weight of coal.

THE Paris Society of Geography, which already possesses a large collection of photographs, requests travelers, missionaries and others to send geographical and ethnographical photographs, especially such as are taken in remote and partly unexplored regions.

UNIVERSITY AND EDUCATIONAL NEWS.

THE annual report of President Eliot, of Harvard University, states that the following gifts and bequests have been made to Harvard University during the past four years:

1891–92	$516,532.20
1892–93	551,136.10
1893–94	182,890.32
1894–95	171,060.92

MISS MARY E. GARRETT, of Baltimore, has endowed a second travelling fellowship of the value of $500 at Bryn Mawr College. The holder, who must have pursued graduate studies for one year at Bryn Mawr College, is enabled to study for one year at some foreign university.

THERE are this year 160 applicants for the twenty-four fellowships annually awarded by Columbia University—75 in the School of Political Science, 42 in the School of Philosophy, and 43 in the School of Pure Science. The candidates in the natural and exact sciences are distributed as follows: Mathematics, 5; mechanics, 1; astronomy, 2; physics, 7; electricity, 2; chemistry, 6; geology, 5; botany, 5; zoölogy, 9; physiology, 1; psychology, 4.

THE convocation of the University of the State of New York will be held on the last Wednesday, Thursday and Friday of June. On Wednesday afternoon the subject for discussion will be 'Aim and Methods in Science Study in Schools below the College,' in which Prof. C. B. Scott, Oswego Normal School; Prof. S. H. Gage, Cornell University, and Prof. C. W. Dodge, University of Rochester, will take part.

DISCUSSION AND CORRESPONDENCE.

EXPERIMENTS SHOWING THAT THE RÖNTGEN RAYS CANNOT BE POLARIZED BY DOUBLY REFRACTING MEDIA.

To the Editor of Science: I have, to-day, made experiments which conclusively show that the Röntgen rays cannot be polarized by doubly refracting substances.

On six discs of glass, 0.15 mm. thick and 25 mm. in diameter, were placed very thin plates of Herapath's iodo-sulphate of quinine. The axes of these crystals crossed one another at various angles. When the axes of two plates were crossed at right angle no light was transmitted; the overlapping surfaces of the plates appearing *black*. If the Röntgen rays be polarizable, the Herapath crystals, crossed at right angles, should act as lead and not allow any of the Röntgen rays to be transmitted.

On the screen covering the photographic plate were cemented the six glass discs carrying the Herapath crystals; also, three discs of glass overlapping so that the Röntgen rays had to pass through 1, 2 and 3 thicknesses of the glass. The screening of these glasses served as standards with which to compare the action of the rays which had passed through one thickness of glass and the Herapathites. On the screen was also placed a square of yellow blotting paper, $\frac{3}{4}$ mm. thick, on which were placed Herapath crystals.

The screen of compressed brown paper was impervious to two hours' exposure to a powerful electric arc light.

On exposing the screen with the six discs and paper square to the Röntgen rays, in three experiments, for $\frac{1}{2}$ hour, 1 hour and for $2\frac{1}{2}$ hours, and developing, *no traces whatever* could be detected of the Herapath crystals on the photographs of the glass discs or on that of the paper square. The contour of the paper was just visible, only by very careful scrutiny. The photographs of the glass discs carrying the Herapathites were circles of uniform illumination; not the least mottling could be detected. Through a magnifying glass these circles appeared with a uniform grain exactly like, in illumination and grain, the photograph of the glass disc having nothing on its surface.

The thinness of these crystals, their powerful polarizing property compared with their thickness, and their low density of 1.8 are the reasons why they do not at all screen (unlike calcite and tourmaline), the Röntgen rays. These well-known facts induced me to make these experiments on Herapathites. They have confirmed in a very satisfactory manner what Röntgen has shown by his experiments, viz., that the X-rays are not polarized by their passage through doubly refracting media.

Alfred M. Mayer.

COLOR VISION AND LIGHT.

In the current number of *The Psychological Review* Mrs. C. Ladd Franklin has written some very appreciative words regarding my article on 'Vision' in the new edition of Johnson's Cyclopædia, but takes exception in very considerate terms to two points which may be worth a moment's attention. The first is to the statement that the retinal cones are sensitive to variations of color chiefly. This was written in connection with an enumeration of certain optical defects common to all eyes; and, of course, there was no intention to imply that the cones are insensitive to that combination of color variations which produces the sensation of white light. Indeed, a previous sentence on the same page may be found which does away with all uncertainty. Nevertheless, the word 'specially' may very appropriately be substituted for 'chiefly.'

The second point is of more importance—a protest against the implication that physicists are satisfied with Helmholtz's theory of vision. My statement that "this theory, with slight modification, is now quite generally accepted by physicists," does not assert that they are necessarily quite satisfied with it. Our opinions are confessedly tentative in proportion to the difficulty of settling the matter by crucial experiments. It is safe to say that no physicist expresses his view upon this subject with any approximation to the confidence with which he asserts the truth of Ohm's law in regard to electric currents. He is compelled to base his statement upon authority; for, as Mrs. Franklin very rightly says, "the physicists have nothing to do with a theory as to what goes on in the retina and in the brain." The practical

question for him, therefore, is to choose between authorities.

No scientific man who has lived during the nineteenth century has been more successful in widely different fields than Helmholtz. During the last dozen years the words physicist and electrician have become differentiated; but both were applicable to him as a distinguished representative. As a mathematician he had few equals. All physicists regarded him as an exceptionally strong physiologist. Whether their view is shared by the psychologists it would perhaps not be proper for a physicist to say. While the domain of the physicist is now fairly well differentiated from that of the psychologist, it is not yet possible to separate the psychologist from the physiologist. If the physicist has been too ready to accept Helmholtz's view on a purely psychological topic, he is to some extent excusable in view of the high position attained by Helmholtz as an investigator in subjects about which the physicist is by special training capable of forming an opinion. No one will maintain that Helmholtz was infallible; but the aggregate of demonstrated mistakes made by him was so small in proportion to the number of important discoveries accomplished that his record may be safely compared with that of any living psychologist.

Upon what experiments, either crucial or even moderately satisfactory, can the psychologist to-day base any definite conclusion as to what goes on in the retina or in the brain during the act of vision? Can it be confidently said that we are yet much wiser than our grandfathers were in relation to this elusive problem? These skeptical questions are not meant to imply any lack of esteem for the valuable work which has been done in psychology, or of admiration for the great ability that is at present directed toward the solution of the difficulties which the psychologist boldly attacks. In accepting the hypothesis of Young that three different sets of nerves respond to the three fundamental color sensations Helmholtz fully recognized its uncertainty. He considered it equally probable that each fibril might serve for three activities completely distinct and independent of each other. (*Handbuch der physiologischen Optik*, p. 292.) This theory has been found so satisfactory from the physicist's standpoint that it is hard to see what advantage would be gained by rejecting it until something else is presented that can be established on better evidence. The case is quite analogous to the physicist's acceptance of the all-pervading, elastic, incompressible ether as the medium through which physical energy is propagated. The existence of some sort of medium in space has to be postulated as a necessity of thought; its properties we infer from the phenomena which are explained on the given assumption. The acceptance is provisional only; we are ready to abandon it as soon as better evidence is presented in behalf of some other theory. Thus far there has not been even a suggestion of better evidence.

If now the psychologists can all agree upon some theory which is quite as consistent with known facts, and which involves less violent assumptions than does the theory of Young and Helmholtz, the physicists will assuredly be ready to welcome what seems to be new truth. To criticise is much easier than to construct. There is practical unanimity among the physicists just at present, but for the psychologists the same can by no means be said. For some time the leading competitor of the Young and Helmholtz theory was that of Hering—a theory which is less simple, and based on assumptions quite as difficult. But we are now informed that "there is one important university in this country in which the theories of Helmholtz and Hering have both been definitely given up, and particularly in the physical department." Granting this, the physicists elsewhere are justified in asking what they should now accept, and what are the positive grounds for acceptance. Several new theories of vision have been propounded within the last few years. One is by Ebbinghaus (*Theorie des Farbensehens*, 1893); another, which is very attractive, is due to Mrs. Franklin; and still another, by Nicati, has been brought forward within the last few months. This is somewhat bewildering for the physicists, who must be modest enough to wait until the psychologists come to an agreement among themselves. It may be true that the Helmholtz theory is preëvolutionary and prepsychological; but the physicists have their

hands too full to stop and examine all these competing theories. To test them is the privilege of the psychologists. Pending the establishment of some one of these new theories by an exhibition of approximate unanimity among the psychologists, the rest of us will be apt to content ourselves as best we may with the theory of vision that has thus far seemed no more objectionable than its successors, and which is fortified by the authority of the greatest German physicist of the nineteenth century.

We are fully aware of certain facts in the history of science that may quite naturally be cited in this connection. The great authority of Newton caused more than a century of delay in the acceptance of the undulatory theory of light. The modification of this theory by Maxwell received but a small share of the credit it deserved until Hertz published the experimental evidence upon which light was shown to be very probably an electro-magnetic phenomenon. As soon as any new theory of visual perception is established upon evidence comparable with that brought out by Hertz, if it conflicts with the Helmholtz theory of vision, this will become of only historic interest, like the emission theory of light. Its fate, however, has not yet been sealed.

In this connection it may be permissible to express my hearty accordance with the views set forth by Mrs. Franklin in a recent contribution to *The Nation* regarding the desirability of greater precision in the use of the word 'light.' The meaning of a word is determined by custom rather than argument. But custom may be gradually modified if those who have occasion most frequently to use a special word or form of expression will agree among themselves to guard against ambiguity. No careful physicist at present includes the ultra-violet or infra-red ether vibrations among light vibrations. The distinction between luminous and non-luminous energy waves is generally accepted and applied. But we need to habituate ourselves to the use of the term 'light-sensations,' rather than 'light,' when reference is made to what is carried to the brain by the optic nerve, whether the origin of the sensation is found in luminous, electric or mechanical energy. The American sense of linguistic æsthetics may be depended upon to prevent the adoption of such cumbrous unhyphened compound words as are tolerated by our German friends. But the scientific demand is for clearness combined with accuracy, for an application of the doctrine of conservation of energy in the giving and taking of ideas. Whatever differences may exist between the physicist and psychologist regarding the explanation of light-sensation, they can certainly clasp hands and agree not to deceive each other by unnecessary vagueness in the use of language.

W. Le Conte Stevens.

THE PHILADELPHIA BRICK CLAYS, ET AL.

I had not thought there was occasion for responding to the article of Prof. G. Frederick Wright (Science, No. 59, p. 242), until inquiry concerning the truth of the matters touched upon began to be made by correspondents. I shall not now take space to state the case fully, but only to say that the term 'Columbia,' as used by Prof. Wright, and indeed as it has been generally used in the past, is a somewhat ambiguous one. It has been made to cover formations, chiefly extra-glacial, widely separated in time, ranging indeed from the beginning of the glacial period nearly to the present. The Jamesburg formation of New Jersey falls within the limits of the Columbia, according to this usage, but the term Jamesburg has never been extended to the extra-morainic drift discussed somewhat fully in the New Jersey geological report of 1893. Most of the Jamesburg deposits of New Jersey are, I take it, relatively young, as indicated by Prof. Wright's citation from my report. But if I interpret rightly, there are remnants of a much older division of the 'Columbia' formation, not referred to explicitly in the report from which Prof. Wright quotes. These remnants are in scattered patches, and are quantitatively unimportant; but they are, as I believe, very significant. If present interpretations be right, there was very extensive erosion after the deposition of the formation of which these patches are remnants, this erosion antedating the deposition of the great body of material which passes under the name of 'Columbia.' Just where in the complex 'Columbia' the 'Philadelphia brick clays' belong, is a question I have nowhere

discussed. While from their general position, I have an opinion as to their age, I have given them too little attention to make it worth while to express that opinion in print. I venture the suggestion, however, that the 'brick clays' may be of various ages. Some of the clays used for brick about Philadelphia (whether 'Philadelphia brick clays' or not is another question) are at low altitudes, and are *younger than the Trenton gravels*, since they overlie them. Others are at much greater altitudes, and are presumptively of different, perhaps very different age. When our work in New Jersey is complete I shall attempt to make as careful a correlation of the various formations, and of their various phases, as the facts at hand shall warrant. Until that time, inferences based on annual reports, which are confessedly 'reports of progress,' are liable to be misleading. Possibly it would be as well not to make them.

Prof. Wright is good enough to refer to the conclusions which I have reached, as a "distinct advance." I, however, do not see any reason to think that my final conclusions are likely to be antagonistic in any important sense to the opinions which I have heretofore held, opinions which are in general harmony with those of Prof. Chamberlin, whose name is brought into the article in question. The most important modification of my own views which has yet taken place is the reference of a larger portion (than formerly) of the Jamesburg to the 'low-level' (younger) division.

I am not personally qualified to speak concerning the Conewango and Allegheny terraces, to which allusion is made; but, if I understand the matter correctly, there has been no abandonment by Prof. Chamberlin and his co-laborers of any essential position relative to the phenomena along the Allegheny River. On the contrary, I have been under the impression, all along, that the detailed study of the region had tended to confirm the essential correctness of the position taken by Prof. Chamberlin long ago.

ROLLIN D. SALISBURY.

UNIVERSITY OF CHICAGO, March 9, 1896.

PRIMITIVE HABITATIONS IN OHIO.

IN a recent discussion between two ethnologists it was advocated that all tribes living in timbered sections constructed houses of logs, bark or saplings, and that the tepee or skin lodge proper was characteristic of the plains. At Oregonia and Fort Ancient, two points in the Little Miami Valley, in Ohio, are large village sites upon which the sunken depressions marking lodge sites are still discernable. One of these areas has been under cultivation; the other is in its natural state. Some of the depressions are circular (the deeper ones), while the others are irregular. Ashes, charcoal, pottery, bones and implements are found in them to a depth of two or three feet, indicating a considerable excavation for the fireplace of each home. Those which are circular may have assumed such shape by natural agencies, as the wash of the soil into the deepest part of the excavation.

A number of the irregular sites were excavated. While the greatest quantity of refuse was found in the center, yet the debris extended on all sides for a distance of 12 or 15 feet. The site itself would vary from 20 by 25 to 30 by 45 feet, and frequently the ashes, pottery and bones were six or seven inches deep near the outer edge.

No modern relics have been found on either of these spots, although a careful examination (covering many months) was made of each. From the excavations it would appear that the habitations were permanent. At one point, considerably below the surface, remains of small (ends) logs eight inches in diameter were found, but it was hard to determine the character of the habitation.

I am of the opinion that most of the houses were of logs, coated with clay, thus forming 'clay domes' after the fashion of the Mandans. My theory is based upon these facts: The depressions, their extent and character; the fact that the first plowing of the southern part of Fort Ancient revealed circular embankments a few inches high, also irregular and slightly raised masses of reddish clay. When the lodge decayed and fell the upper portion would naturally fall into the entire space enclosed. As the walls immediately above the base were thick, when they fell the circular ring was formed.

The farmers also stated that the clay in these

circles was in chunks and hard as if sun-dried or slightly baked.

Warren K. Moorehead.

QUESTIONS REGARDING HABITS AND INSTINCT.

For purpose of extended comparison we wish data as to habits, instincts or intelligence in animals, above all, minor and trifling ones not in the books, *useless or detrimental* ones, and the particular *breed*, *species* or *genus* showing *each*. Examples; Purrings licking; washing face; kneading objects with forepaws, humping back, and worrying captured prey (like the cat); baying at moon (or otherwise); urination and defecation habits (eating, covering up, etc.); disposition of fæces and shells in nest; rolling on carrion; cackling (or other disturbance) after laying; eating 'afterbirth' or young; sexual habits; transporting eggs or young; nest-sharing; hunting—partnerships, or similar intelligent associations; hereditary transmission of peculiar traits; rearing young of other species with resulting modification of instinct; feigning death; suicide; 'fascination' *and any others*. Circular of information will be sent and full credit given for data used, or sender's name will be confidential, as preferred. Answer as fully as possible, always stating age, sex, place, date (or season), species, breed, and whether personally observed.

G. Stanley Hall.
R. R. Gurley.

Clark University,
Worcester, Mass.

NEWLY HATCHED CHICKENS INSTINCTIVELY DRINK.

Editor of Science: In your issue of March 6, 1896, appears an excellent and accurate note by Wesley Mills, calling attention to an error of statement made by Prof. Morgan in Science (issue of February 14, 1896).

With due deference to '*The Writer of the Note*,' who follows Mr. Mills, and who says that Morgan's argument is satisfactory—that "a chick might die of thirst in the presence of water," I desire to say that this is not my understanding of the case. I have been, during the last thirty-five years, a breeder of fowls as an amateur, and I have given the hatching and rearing of chickens close and continued attention.

I have repeatedly placed a shallow water dish before the bars of a coop in which a newly hatched brood had been placed the day previous, taken there directly from the hatching nest, and in which they never had food or water offered. Repeatedly, before these small chickens, not twenty-four hours from the shell, and before they had been offered food, I have filled their shallow water tray, and observed them toddle out to it, peck at it, or at once thrust their bills into it, *to drink at once by uplifting their heads*, as all adult fowls do, the hen never putting her head out from the bars, or showing these young chicks how to do what they instinctively did. I have made the same experiments repeatedly with food, with the same result, *i. e.*, that chicks instinctively drink and eat without any example being set by the mother hen. Henry W. Elliott.

Lakewood, Ohio, March 11, 1896.

SCIENTIFIC LITERATURE.

Moderne Völkerkunde, deren Entwicklung und Aufgaben. By Thomas Achelis. 1 vol., 8°, pp. 487. Stuttgart, Ferdinand Encke. 1896.

The author of this work is a 'doctor juris' in Bremen, and the writer of several treatises on the development of the modern science of ethnology, properly so called. In the present volume he proposes to define the true aims of that branch of research by an investigation in the first place of its historical development; secondly, of its contents; and thirdly, of its relations to other departments of knowledge.

He expressly states that the words 'Völkerkunde' and 'Ethnologie' mean one and the same science (p. 300), the aim of which is 'to set forth the development of mankind in its different branches and their various stages of culture, and thus obtain, as nearly as possible, a correct picture of a complete and organic whole.' These stages of culture must be regarded as the constituent elements of a continuous mental process or growth, and thus reveal the unfolding of the universal human consciousness.

In this manner, ethnology leads up to philosophy, which thus enters into the category of the inductive sciences, and wins for itself a sub-

stantial foundation in objective and experimental truth, through the lack of which, up to the present time, it has failed to render any permanent and serious contributions to human knowledge.

The author draws a sharp line between ethnology and physical anthropology. The former concerns itself with man exclusively as a social being, in his relations to other men, in his life in societies, peoples or nations; the latter finds its proper field in studying the individual, and solely from his anatomical and physical side, strictly excluding psychic phenomena. This distinction, to which the author rigidly adheres, is, we believe, erroneous, inconsistent with natural relations, and a serious blemish in this otherwise excellent construction of ethnologic science. Modern psychology cannot be divorced from physiology and anatomy, neither in the individual nor in the folk; and that Dr. Achelis so constantly underrates their essential connections can be explained only by the fact that his professional studies have been legal and not medical.

In his psycho-physics, he depends chiefly upon Wundt, unquestionably an authority of the first rank, but whose analysis of self-consciousness, and whose rejection of the capacity of self-observation, have been amended by later specialists in this branch. Another point of incompleteness in his developmental theory is the deficient appreciation he manifests of the relation of degeneration to progression. Indeed, he would exclude retrogressive metamorphosis from the primary factors of social evolution; whereas, it is an indispensable condition of such evolution in most, if not all, instances, just as it is in organic forms.

Having thus set forth the author's theoretical positions, the method of their presentment may be considered.

The science, he argues, began with ethnographic pictures, such as those offered by Lafitau and Cook, which were worked up politically by Montesquieu, Rousseau and others, philosophically by Herder and Schiller, geographically by Ritter and Reclus, etc. These gave the foundation for ethnology as the science of sociology, in which the names of Spencer, Quatrefages, Bastian, F. Müller, Waitz, Tyler, Post and others are familiar to most readers. Three hundred pages of the volume are devoted to careful epitomes of the labors of these scholars, and then the author feels himself ready to present his own definition of ethnology and description of its aims. These have already been briefly mentioned, and it is enough to add that he supports them by an analysis of the material and intellectual culture of humanity, such as arts, languages, religions, laws, commerce, etc.

The third division of the treatise exhibits the bearings of ethnology on other sciences, especially geography, archæology, history, religion, philosophy and sociology. It is brief, not forty pages in all, and unsatisfactory. It shows signs of haste and inadequate treatment, as anyone can see by reading the three pages on anthropogeography.

In spite of the defects which we have freely pointed out, the work as a whole is admirable, breathing the spirit of advanced thought, representative of the leading school in the study of man, and rich in suggestions for further investigation. The style is clear, the language forcible, and the presentation popular. It deserves a marked success.

The Child and Childhood in Folk-Thought. (The Child in Primitive Culture.) By ALEXANDER F. CHAMBERLAIN, M. A., Ph. D., etc. Pp. 464. New York, Macmillan & Co. Price, $3.00.

This work supplies a want in the literature of folk-lore, and supplies it well. It must have been a pleasant occupation to the author to collect the mass of material he presents us, from the family and folk-talk of all times and all peoples, to illustrate how they regarded the little creature, the child, for whom alone, indeed, the family has any reason of existence.

It is astonishing to note what an important part he has played in the life and opinions of his elders, and what diverse powers he has exhibited or been credited with. Two hundred pages of the book are filled with descriptions of the child as a builder of society, as a linguist, actor, poet, teacher, judge, oracle-interpreter, weather-maker, healer, priest, hero, fetich, divinity, God. Six chapters are filled with the

proverbs, sayings and saws about the child in its various relations to the family; and the volume opens with three chapters replete with attractive examples of the child's tribute to its mother,— delightful exemplifications of the deep and holy impress which maternal love has left on the soul of the race.

Childhood is spoken of as the golden age of life, 'a moment of God,' 'a time of June,' its days as 'halcyon days,' a 'heaven on earth;' a belief, says the sanguine author, 'shared alike by primitive, savage and nineteenth century philosopher.' We wish, indeed, this were so; but, alas! our own observation is that out of a dozen persons asked, ten will tell you that the period of their childhood was by no means the happiest portion of their lives. In sad truth, the golden age of childhood is as much a popular delusion as the golden age of the world. We think of it as such merely because we forget the numberless little miseries which we then endured, and which at the time were grave and great to us.

But apart from this question of fact, about which the author's opinion in no wise injures the excellence of his labors, the thorough sympathy he has with children, their thoughts and doings, beautifies his pages and renders them charming reading as well as sovereignly instructive. He is no gleaner of dry stubble, but delights in the literary and poetic sides of his inquiry, and brings under contribution the bards, the dramatists and the moralists of the world. His reading has been wide, and not at second-hand, or through translations, but in the originals of a dozen tongues; as we might expect from one who has already made his mark as a comparative linguist.

A most useful bibliography of 549 titles and two ample indexes close his volume, and add vastly to its value to the serious student of folk-lore.

D. G. Brinton.

Practical Inorganic Chemistry. By G. S. Turpin. London and New York, Macmillan & Co. 1895. Pp. 158+viii.

This little book is evidently intended for the use of pupils in secondary schools. The first four chapters contain directions for weighing and measuring solids and liquids, for determining specific gravity, for measuring gases and observing their behavior under changes of temperature and pressure. The study of chemical action begins with an examination of the effect of air upon different metals. In these experiments the students find out that the balance is of very great service in interpreting the nature of chemical changes. The results of one experiment suggest the making of another experiment and so the work goes on step by step until the pupil finds it possible to separate the active and inactive constituents of the air and this leads him naturally to a determination of its volumetric composition. Oxygen and nitrogen are then studied more thoroughly and a quantitative analysis is made of potassium chlorate. Water and hydrogen are examined in a similarly thorough manner, and in connection with the latter the equivalent weights of a number of the metals are determined.

Only a few of the more common nonmetallic elements are dealt with. The chief merit of the book lies in this, that due attention is everywhere given to the quantitative side of chemical phenomena. It is shown how with very simple apparatus beginners can determine the relative quantities of substances that interact, and can acquire a knowledge of important laws of the science. The only criticism that might be made is that the apparatus and methods used in some of the quantitative work, as, for instance, in measuring gases by the volume of water displaced, are so very simple that by means of them only roughly approximate results can be obtained. An improvement in this direction would be made by collecting the gases in graduated gas measuring tubes, and correcting the gas volumes for the tension of aqueous vapor.

Taken altogether, the course of laboratory work here given is a most excellent one. It is refreshing to meet with a laboratory manual that is not simply a collection of qualitative tests for substances. This little book can be heartily recommended to all who are engaged in teaching elementary chemistry.

E. H. Keiser.

Chemical Experiments—General and Analytical. By R. P. Williams. Boston, Ginn & Co. 1895.

The author has arranged this course of chemical experiments for students in high schools, academies and colleges. In the first half of the book the usual experiments upon the preparation and properties of the non-metallic elements are given, while the latter half consists of a series of analytical tables giving the behavior of solutions of metallic salts under the influence of the various reagents. The laboratory directions in the first part are upon the whole clearly stated, but they are marred by the excessive use of abbreviations and formulas. For example, in experiment 34 the student is directed to "connect the flask with a large t. t. or with a rec. which contains no water, and from this t. t. or rec. have a d. t. leading to a p. t. so as to collect the gas over water." In the introduction, page xi., the students are instructed to keep notes in the following way: "I, ———, put the mixture into a t. t., adjusted a d. t., hung it to a r. s., and arranged so as to collect the gas in recs. over water in a p. t." Nearly everywhere in the book symbols are used instead of the names of substances. Surely to encourage pupils to imitate this example is to confirm them in slovenly habits.

Another feature of the book to which exception must be taken is that entirely too much attention is given to 'tests.' The main idea seems to be to give the 'tests' for each substance, and a pupil taking this course would most likely get the idea that practical chemistry consists in finding the 'tests' for various substances. There is not in the whole course a single experiment which serves to elucidate any one of the fundamental laws of the science.

Such a method of teaching chemistry to beginners cannot be recommended. Instead of teaching them to distinguish ferrocyanides from ferricyanides, tartrates from oxalates, it would be much better for them to study the chemistry of common things, of air, water and fire, and this study should not be confined to the qualitative side of the phenomena observed. It is not impossible to teach beginners how certain chemical changes can be studied quantitatively and to arrange a course of experiments for them so that they shall acquire some knowledge of the chief laws and principles of the science.

E. H. KEISER.

Einführung in die mathematische Behandlung der Naturwissenschaften. Kurzgefasstes Lehrbuch der Differential- und Integralrechnung mit besonderer Berüchsichtigung der Chemie. By W. NERNST and A. SCHÖNFLIES. München und Leipzig, E. Wolff. 1895. Pp. xi+309.

One of the authors of this book, W. Nernst, is professor of physical chemistry at the University of Göttingen; his collaborateur, Professor Schönflies, is attached to the department of mathematics at the same seat of learning. This union of forces has been a fortunate one, for the writers have certainly succeeded in carrying out their intention of facilitating the study of the higher mathematics for students of natural science.

The keynote of the authors' purpose is sounded in the following lines, which they introduce in their preface as a quotation from H. Jahn's recent publication on electro-chemistry: "Even chemists must gradually grow accustomed to the thought that theoretical chemistry will remain for them a book with seven seals, unless they shall have mastered the principles of higher mathematical analysis. A symbol of differentiation or integration must cease to be an unintelligible hieroglyphic for the chemist * * * if he would not expose himself to the danger of losing all understanding of the delopments of theoretical chemistry.

"For it is a fruitless endeavor to attempt, by lengthy descriptions, to elucidate—even partially—that, which an equation conveys to the initiated in a single line."

The opening chapter discusses the principles of analytic geometry. After a few introductory remarks on graphic methods of presenting experimental results, and after having referred to the axes of coördinates, abscissa and ordinate, quadrants, etc., loci and their equations are considered. The circle, the parabola, the straight line, the ellipse, receive due attention, examples and problems being given to illustrate the discussions.

The second chapter is devoted to the fundamental principles of differential calculus. The introductory paragraph of this chapter —on the principles of the higher mathematics and the methods of consideration employed in the natural sciences—is well worthy

the perusal of any scientist, no matter in what direction his interests may be enlisted.

Following this are chapters on the differentiation of simple functions; integral calculus and its applications; higher differential equations and the functions of variables; infinite series and Taylor's series; the theory of maxima and minima; solution of numerical equations; examples from mechanics and thermo-dynamics. Collections of problems and formulæ precede the index, which completes the volume.

The aim of this book is fully expressed by its title; its scope is indicated by the above summary of its contents.

Although not a pioneer in this particular field—A. Fuhrmann's Naturwissenschaftliche Anwendungen der Differential-rechnung was published in 1888, the appearance of this treatise must be pronounced most opportune. It is certainly deserving of a cordial welcome, and mastery of its contents can not fail to be of great value to all who have not already appreciated the important bearing of the higher mathematics on numerous problems of natural science. FERDINAND G. WIECHMANN.

SOCIETIES AND ACADEMIES.

BIOLOGICAL SOCIETY OF WASHINGTON—257TH MEETING, SATURDAY, MARCH 7.

A PAPER on *the Influence of Fruit-bearing upon the Mechanical Tissue of the Twigs*, by Adrian J. Pieters, was, in the absence of the author, read by George H. Hicks. The author's conclusions, based on a study of twigs of the apple, pear, peach and plum were that the one-year-old fruit-bearing shoot of the apple and the pear has less wood in proportion to its diameter than does the vegetative shoot of the same age. This is due, in the apple largely, and in the pear solely, to a great increase in the cortex of the fruit-bearing shoot. It does not, however, appear from the structure of the shoots that the fruit-bearing shoot is weaker than the vegetative. The former is well supplied with supplementary mechanical tissue which is distributed at those points where it is most needed. This gives an increase of strength for the fruit-bearing year, which fully makes up for the small difference in xylem. In the peach the fruit-bearing shoot has more wood than the vegetative, and the walls of the wood cells are as thick in the former as in the latter.

In general it may be said that the effect of fruit-bearing upon the tissues is local. In the apple and pear it is felt throughout the one-year-old shoot; in the plum and peach it is confined to a small area in the immediate neighborhood of the fruit stalk.

The local effect on fruit-bearing is towards an increase of cells and a decrease in the thickness and lignification of the walls of the wood cells. The cortex is especially enlarged, giving rise in the apple and pear to the characteristic swollen condition of the fruit-bearing shoot.

In all cases the increase in growth is greatest on the side near the fruit stalk, although the wood in the apple and pear is best developed on the side of the lateral vegetative bud.

The effect which fruit-bearing exerts upon the xylem disappears with time. The study of apple shoots that had borne fruit in their first year showed that in the two or four years following there had been a rapid increase of wood, especially on the side of the fruit scar which was weakest at the end of the first year. At the end of three and five years these shoots had a better xylem development than shoots of the same age that had never borne fruit.

Fruit-bearing has a local effect upon the lignification of the walls of wood cells. It prevents their lignification wholly or in part according to their distance from the fruit stalk.

The lignification of other cell walls is promoted by fruit-bearing. In the fruit stalk the greatest part of the tissue has become lignified, and in the upper part of the apple and pear shoots there is an abundance of sclerenchyma and hard bast, which is either not found in the vegetative shoots or only in small amounts.

Dr. E. L. Greene presented a paper on *The Distribution of Rhamnus and Ceanothus in America.* Of the first named genus, the European *Rhamnus cathartica* being its type-species, some 100 species are recognized, these being distributed all around the northern hemisphere, chiefly within the temperate zone. In contrast with Europe, which has 23, North America north of

Mexico is poor in species, not more than 12 or 14 being credited to our territory. Four of these are of the Atlantic slope of the continent, the rest belonging exclusively to the Pacific slope. That narrow strip of territory intervening between the crest of the Sierra Nevada and the Pacific has more than twice the number of Rhamnus species exhibited by all the vast area of the United States besides. Each one of the far-western species occupies an altitudinal belt of its own, never trespassing upon the territory of another species; *R. Californica*, for example, inhabiting the Coast Range hills, from near the level of the sea up to an elevation of several hundred feet. In the dry interior region lying between the two mountain chains, *R. tomentella* holds the field as exclusively, this at altitudes varying from 300 to 3000 feet. Then, after passing the region of this shrub of the dry interior, and reaching an altitude of about 5,000 feet, where there is deep annual snowfall, there occurs a narrow belt of an exceedingly distinct species, *R. rubra*; this shrub being deciduous, while both its allies of the lower altitudes are evergreen.

Ceanothus, the genus of shrubs, most nearly allied to *Rhamnus*, instead of being like that, almost cosmopolitan, is confined to North America; where only 4 out of the whole number of more than 60 sorts are of the Atlantic slope; some 6 belong to Mexico and Arizona; all the remaining 50 occurring within the limits of the State of California; no fewer than 40 of them being strictly limited to that State, where the Coast Range seems to be the special home of the genus.

The two eastern species, *C. Americanus* and *C. ovatus*, which are the type of the genus, have but one near ally, and that is the far-western *C. sanguineus*. The two Floridan species, *C. microphyllus* and *C. serpyllifolius* are in affinity far removed from the other Atlantic species, and are separated from their only near relatives, certain species of the Californian Coast Range, by a distance of more than 2,000 miles. Again, one species peculiar to islands near the California coast is related to none of the species of the closely adjacent mainland, but has its near kindred more than 1,000 miles southward, in central Mexico.

Frederick V. Coville spoke of *Different Editions of Some Government Expedition Reports*, stating that several editions of the reports of the expeditions of Emory, Stansbury and Fremont had been published, and that not only were there differences in the pagination, but, in some instances, changes in the text, these alterations in some cases affecting the specific and even generic names of plants. Anyone quoting from these reports, the speaker said, should be careful to state exactly which edition was referred to.

F. A. LUCAS,
Secretary.

THE WOMAN'S ANTHROPOLOGICAL SOCIETY.

THE 140th meeting of the Society was held February 29th, the day being devoted to Archæology. Miss Sarah A. Scull gave a talk on the growth of Art in Egypt, Chaldea, Assyria and Greece, and comparisons were drawn between Semitic and Aryan arts. All sections of the Society, in their studies, are looking especially towards this point—differences in the two families, Semitic and Aryan—and many interesting comparisons have been drawn in the section meetings as well as in those meetings that have been open to the public. Miss Scull's remarks were illustrated by stereopticon views, many of which were from photographs taken by herself.

The meeting of March 14th was in charge of the section for Child-Life study. Mrs. Eudora Lucas Hailmann, who has devoted her life to study of the child in the Kindergarten, presented her views on the use of symbols in early education. In the treatment of the subject, the address had reference entirely to children of the age from three to seven inclusive. Normal, vigorous children of these ages do not speculate, do not dream day dreams, do not see sprites in the flowers, nor ogres in the forest, unless they have been put there by older heads. Their eager, active, healthy minds and bodies are too much absorbed in the immediate interesting beautiful wonders that surround them. There is no need to stimulate their love and admiration for life by artificial means, and they have not reached the contemplative, speculative age of abstract thinking. To force

this upon them at this period of development is to make them precocious, and consequently, to arrest development and to rush them into degeneracy. The child, if left to himself, will discover symbolism in nature. When it is given to him ready made it has a tendency to render him superstitious, credulous and superficial. During these specially sensitive years of early childhood impressions should be pure, clear, direct and complete. The brain, at this period, is more susceptible and much more active, consequently much more intensely conscious, that in later life, eagerly clinching every new impression in order to make use of it in giving expression to its own individuality, which has become firmly rooted in the loves and lives of its environment. The thought centers for this period should be full of instruction and abound in beautiful sentiment.

There is current a doctrine that in each child there are repeated the various phases of development in the life of humanity. It should be remembered, however, that the earlier stages of development, through which the child must pass, are meant, by the very laws of evolution, to sink into rudimentary conditions. To emphasize them must result in arrested development and retard the progress of the race. Education should treat them in such a way as to reduce to a minimum their influence in the life of the child and to assist him to use all his strength in living intelligently toward the ideals of the race. The crudities and superstitions transmitted to us in the myths and allegories of past ages can stimulate only crudity and superstition in the minds of little children whose mental development is not sufficient to enable them to see and appreciate their latent truth and beauty. To force such myths and allegories upon children at too early an age will, on the one hand, subject them in later years to painful struggles to overcome morbid tendencies, and, on the other hand, will blunt their sensibilities to the truth, beauty and love in their environment. Moreover, when persons tell such myths and allegories to little children they labor to adapt them to the children's understanding, in what they call simpler language, and mar both the story and the child.

A. Carman,
Secretary.

THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, PA., FEBRUARY 10, 1896.

A paper entitled 'Summary of New Liberian Polydesmoidea,' by O. F. Cook, was presented for publication.

General Isaac J. Wistar called attention to the apparently capricious distribution of iron oxide as coloring matter in the rocks of the anthracite coal region. A section in Lykens Valley, for example, shows a thick stratum of red shale below the carboniferous series. It is overlaid by thin green sandstones, the color of which is due to another oxide of the same metal. Upon this rests the thick masses of the Pottsville conglomerate, a white quartzite which shows no coloration from iron, except perhaps a slight external tinge on the enclosed quartz pebbles. Above the conglomerate we find intercalated among the sand stones of the coal measures sixteen coal seams of varying thickness, of which the lowest three show a red ash, several below them a white ash, while the upper three return to a red or pink ash. Above the coal measures there are no signs of iron coloration until, in other localities, the Trias is reached, when we find the red coloring as pronounced as in the carboniferous shales.

These several strata cover a long period in geological history and exhibit the following phenomena: During the red shale period the presence of iron oxide was sufficient to give a high color to the entire deposits. During the still longer period of the conglomerate the available iron, having been all distributed in the red shale, did not appear at all and the conglomerate beds show none. In the deposit of the three lowest seams a fresh supply of iron appears, enough to color their mineral constituents red. Then ensued a long series of coal seams containing little or no iron, to be followed by several red-ash seams near the top of the series. There is then an entire absence of iron in sufficient quantity to color the rocks, until, when the Triassic period occurs, evidences of the universal distribution of iron oxide are more abundant than ever.

These facts appear to show several points during which the accessible supply of iron was exhausted by complete distribution in the strata

under process of deposit, with intermediate and subsequent periods during which new supplies appear from some source not yet clearly explained.

Prof. Amos Peaslee Brown stated that it had been suggested by Russell that the red color of certain formations may have originated from the subaërial decay of iron-bearing rocks and the subsequent deposit of this material as sediment forming the red rock. Such rocks as contain iron, especially limestone and the metamorphic schists, would weather in the atmosphere to reddish clays, and during periods when denudation of the surface was not active, or when the land remained at constant level, such weathered accumulations could form to considerable depths. A rise of land level would cause denudation of this accumulated red soil and result in deposit elsewhere. The periods preceding the formation of the Mauch Chunk red shale and the New Red or Trias were such periods of quiescence and they were followed, in the first case locally and in the second generally, by elevation of land causing denudation to be set up and accumulation of red clays to be formed.

So far as the ash of coal is concerned, it is probable that the color is due to the way in which pyrite is contained either in the coal itself or in the slates adjoining. Coal containing separable pyrite would give white ash, while if the pyrite is intimately mixed in the coal the ash will be red.

The subject was further discussed by Messrs. Heilprin, Willcox, Goldsmith and Lyman.

Mr. Jos. Willcox and Prof. Angelo Heilprin commented on the evolutionary value of the large collection of Fulgurs presented at the last meeting, the former claiming that about twenty-five species had been reduced, by the presence of complete series of intermediate forms, to three or four.

EDW. J. NOLAN,
Secretary.

NEW YORK SECTION OF THE CHEMICAL SOCIETY,
MARCH 6, 1896.

THE papers presented were:

The Cassel-Hinman Gold and Bromin Process: P. C. MCILHINEY.

The Specific Gravity of Glue Solutions: E. R. HEWITT.

Investigations in the Chemistry of Nutrition: W. O. ATWATER.

Mr. McIlhiney enumerated the advantages of bromin over chlorine in the gold extraction process, as (a) greater solubility in water of bromin, 3.2 per cent. against 0.76 per cent. of chlorine; (b) lesser oxidizing power, whereby the iron pyrites is less acted upon; (c) greater solvent power of bromin for gold.

The bromin is recovered by distillation with live steam in stone tanks, after addition of sulphuric acid and an oxidizing agent, as permanganate of potash.

The process is especially adapted to the treatment of low grade telluride ores which have not hitherto been profitably worked.

Mr. Hewitt in his work on specific gravity of glue solutions had obtained his results from experiments on twelve different grades of glue, from the best photographic gelatine to the darkest and poorest grades in the market. He finds the expansion of glue solutions to be the same as water alone; that the specific gravity of glue containing moisture is less than of glue in the dry state; that the hydrometer could not be used in solutions containing over 65 per cent. glue, and that the specific gravity is independent of the quality of the glue.

He concludes that there is a series of distinct chemical combinations of glue with water.

Dr. Atwater described the recent work under his direction at Middletown, Conn., in determining the heats of combustion or fuel values of foods. He said that 'we know the laws of the conservation of energy hold good in the living organism, but we do not yet know *how* they held good. We must study these things in the living organism, and for this purpose a 'respiratory calorimeter' has been constructed of copper, large enough for a man to remain in for some time, and by which the experimental determination of heat of radiation, energy of food consumed, etc., is to be carried out.'

Experiments lasting four days had recently been made, and it was expected to arrange to keep a man in the apparatus by the week.

Eight attendants were required to conduct these experiments, four by day and four by

night, keeping temperature records, weighing the food, making analyses, etc.

In reply to questions as to effect of food on the quality of the fat, Dr. Atwater stated that experiments made on dogs had conclusively proved that the fat formation is a function of both the organism and the food.

DURAND WOODMAN,
Secretary.

GEOLOGICAL CONFERENCE OF HARVARD UNIVERSITY, FEBRUARY 18, 1896.

1. *An Occurrence of Theralite in Costa Rica.* By J. E. WOLFF. To be published in Amer. Jour. Sci., April, 1896.
2. *The Harvard Meteorological Stations in Peru.* By R. DEC. WARD.

In 1887 a considerable sum of money was left to Harvard College Observatory by the will of Mr. Uriah A. Boyden, to aid in the establishment of an observatory "at such an elevation as to be free, so far as practicable, from the impediments to accurate observations which occur in the observatories now existing, owing to atmospheric influences." In order to select the best possible location for the new observatory, expeditions were undertaken, in 1888 and 1889, to Colorado and California, where astronomical work of various kinds was done at a number of different places. None of the stations thus temporarily occupied proved entirely satisfactory, and it was finally decided to establish the new station in Peru, where Messrs. S. I. and M. H. Bailey had, in the mean time, obtained some excellent results in connection with astronomical work done by them for the Harvard College Observatory on Mt. Harvard, in Peru. The expedition which was sent out to build the new observatory left the United States, under the direction of Prof. Wm. H. Pickering, in December, 1890, arriving at its destination the middle of the following January.

The meteorological advantages for astronomical work in the region selected for occupation are very great. The temperature seldom falls below 40° and seldom rises above 75°. The rainy season is very short, and but little rain falls, generally less than four inches. November marks the beginning of the cloudy season; December is fairly clear, and January to March are cloudy and rainy. During the rest of the year the atmosphere is very dry, and the sky prevailingly clear. In the rainy season it by no means rains every day, there being often a week or a fortnight during which no rain falls. The excessive dryness of the climate, in which vegetation is maintained only by constant irrigation, the short rainy season and the small amount of cloudiness combine to make this a most favorable region for astronomical work.

There are at present eight meteorological stations in Peru, maintained by the Harvard College Observatory. The principal one is at Arequipa, where the observatory is situated at an altitude of 8,050 feet above the sea, and about 80 miles from the coast. The city itself is situated in a little oasis formed by a river valley at the foot of the Cordillera, a little above the lower-lying desert. At Mollendo, on the seacoast, there is a meteorological station 85 feet above sea level. Between Mollendo and the main station at Arequipa, another station has been established, at La Joya, about in the center of a rainless, barren region, and at an elevation of 4,140 feet. The most interesting station of all is that on the summit of the volcano El Misti, 19,200 feet above the sea, lying northeast of Arequipa, about ten miles distant. This station, established after much hardship and maintained with considerable difficulty, is now the highest meteorological station in the world. Mr. S. P. Fergusson, of Blue Hill Observatory, Massachusetts, has recently constructed a meteorograph for the Misti, which records automatically temperature, pressure, humidity, and wind direction and velocity, and will run three months without rewinding. This instrument will obviate the necessity of the frequent visits now made to the summit by the observers at Arequipa.

The other stations are as follows: Flank of El Misti, 15,700 feet, about the altitude of Mont Blanc; Alto de los Huesos, 13,400 feet, a high desert plateau east of El Misti; Cuzco, between the eastern and western Andes, 16,100 feet, and Santa Ana, east of the Andes, in the Urubamba Valley, 3,400 feet above the sea.

This continuous line of stations, reaching from the coast inland over 350 miles, and including such great altitudes as the summit and flank of

El Misti, is equalled nowhere else in the world, and the results which the data there collected will furnish are certain to be of the greatest importance to meteorology.

MARCH 3, 1896.

Geography and Geology for Training and Elementary Schools. By R. E. DODGE.

A teacher in a training school for teachers has before him a double task, especially if his subject be one that can also be taught to the children. The teacher of geography and geology has such a specialty, and hence the requirements upon his abilities are somewhat general and diversified. He must, on the one hand, give to the students preparing under his guidance to become teachers, such a scientific understanding of the principles of the sciences that they can go out into active teaching well equipped for their work. On the other hand, he must see that the children in the elementary schools, which are now usually attached to training schools for purposes of observation and practice by the would-be teachers, are given the principles of geography and geology in a way that best illustrates the principles of matter and method he is presenting to his students. In both cases he should recognize that the matter presented should be scientifically treated and scientifically accurate, the method of presentation varying so as always to be adapted to the minds of the pupils.

The would-be teachers must, from the usual inadequacy of their previous training, be well drilled in the principles of the sciences before they are given conceptions of the methods of adapting the matter of the sciences to the younger children. The scientific spirit of interest and inquiry and of rational imagination should be developed as strongly as possible, that the teacher may impart such a spirit to the pupils under her, no matter what their age.

Inasmuch as geography is the most important of all the sciences to be taught in the schools, the teacher should be given only so much geology as would make her best understand the principles of geography. The treatment of geography should give the facts, related in a rational and scientific way, so that she gains not only matter, but the ability to adapt to her own needs any matter that she may be called upon to use.

A teacher thus equipped scientifically, so that she understand the underlying principles of geography, physical, political, descriptive and commercial, can adapt herself to the conditions she meets, so as to become more than a repeater of the matter contained in text-books. Text-books then become, as they should be, suggestive sources rather than complete repositories of matter.

If the principles of geography are presented to the children in the same scientific way, so as to arouse them to observation and investigation, their interest is at once increased, the whole science becomes alive to them, and they are eager to go on and to learn more.

A course in geography for schools should be graded, scientific, and framed so as to impart an understanding of and a love for nature. It should begin with a conception of the processes shown in the daily and seasonable changes about the home. With that as a basis, the child can be lead to an understanding of the other parts of the world, both similar and dissimilar, and becomes more appreciative of the form and meaning of the earth's features. By building little by little upon such a beginning, the pupil can, in the eight years previous to the high school, gain a conception of the relation of man to the geographic features, such as can be rarely if ever given by the method of teaching geography as something to be memorized.

In a course that includes geography, in its many aspects, botany, zoölogy and meteorology, it is possible to give the child a large amount of locative and descriptive geography, and an understanding of the reasons for the customs, habits and development of the great nations; for the routes of commerce and explorations, etc., etc. In this way the child gains an understanding of the world and an ability to interpret the world for himself, that will be of great service to him even after he has forgotten many of the details that he may have memorized. He gets an ability to make use of his powers in adapting himself to new conditions, such as he could never get were the science only taught as a subject for memorizing and not for reasoning.

In the whole course for teachers, if the matter, method and the scientific spirit be kept in mind, the teachers go to their work with a liking for it which is not gained otherwise. A course in geography for teachers and children along the lines suggested above has been planned and is now in operation in the Teachers' College, New York City, and though it is in its first year of operation the result is very pleasing, and the promise for future good results is most encouraging. The constantly increasing interest, as well as understanding, of the children shows that the conception that physical geography can not be profitably given to young children, is erroneous. If it is given in a way to arouse them to thought it becomes a means of drill that is of great service, and that develops more of their powers than if they were simply required to do a lot of memorizing of description and location, without any scientific underlying thread connecting the various topics considered.

Experiments imitative of Glacial Esker and Sand-Plain Formation. By C. W. Dorsey.

A preliminary account was given of a series of experiments performed under the direction of Mr. T. A. Jaggar in the Laboratory of Experimental Geology. The object of the experiments is to reproduce in miniature the conditions of delta deposition at the mouth of a subglacial cavern, with a view to systematic study of the conditions that govern the form of deltas, the arrangement of bedding in cross-section, the development of lobate margins and the influence of variations in stream velocity, coarseness of material and water level. The apparatus used consists of a tin half-tube whose cross-section has the form of an inverted U, and this is longitudinally bent into somewhat serpentine form, to imitate a subglacial stream cavern; a funnel soldered at its upper end supplies load, and a rubber tube from the hydrant supplies the current. Thin sheet lead is bent over this apparatus to represent roughly the form of a glacier front, and the whole is arranged in a large square tank. On starting the current, sand, fine gravel and mixtures of sand with plaster are fed into the funnel and are deposited in a fan delta at the cavern's mouth. The structures obtained may be photographed at any stage, and at the end of each experiment the imitation cavern is removed to show the deposit that represents the feeding esker. On slicing the deltas horizontally and vertically the progressive stages of growth are beautifully shown by the white plaster layers, and in this way migration of the lobes and of the frontal scarp of the delta, as well as the arrangement of cross-bedding, back-set beds, etc., may be traced. An attempt with ice is in preparation, to test the effect of the melting away of the ice on the resultant forms.

The results of these experiments will be offered for publication in the near future, probably in the Journal of Geology.

T. A. Jaggar, Jr.,
Recording Secretary.

NEW BOOKS.

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Grundriss der Krystallographie. Dr. Gottlob Lenck. Jena, Gustav Fischer. 1896. Pp. vi+252. M. 9.

Elements of Botany. J. Y. Bergen. Boston and London, Ginn & Co. 1896. Pp. v+57.

Voice Building and Tone Placing. Holbrook Curtis. New York, D. Appleton & Co. 1896. Pp. xii+215. $2.00.

The Whence and Whither of Man. John M. Tyler. New York, Charles Scribner's Sons. 1896. Pp. xv+312. $1.75.

The Dynamo. S. R. Bottone. London, Swan, Sonnenschein & Co., Lim.; New York, Macmillan & Co. Pp. 116. 90 cents.

Transactions of the American Climatological Association for 1895. Vol. XI. Philadelphia, Pa., printed for the Association. 1895. Pp. xv+266.

Experiments in General Chemistry and Notes on Qualitative Analysis. Charles R. Sanger. St. Louis. 1896. Pp. 49.

Laboratory Experiments in General Chemistry. Charles R. Sanger. St. Louis. 1896. Pp. 59.